



POPULAR

SCIENCE

MONTHLY

Mechanics & Handicraft

JULY

15¢

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PAGE
46

*Ever wish you had Cat's Eyes
for Night Driving?*

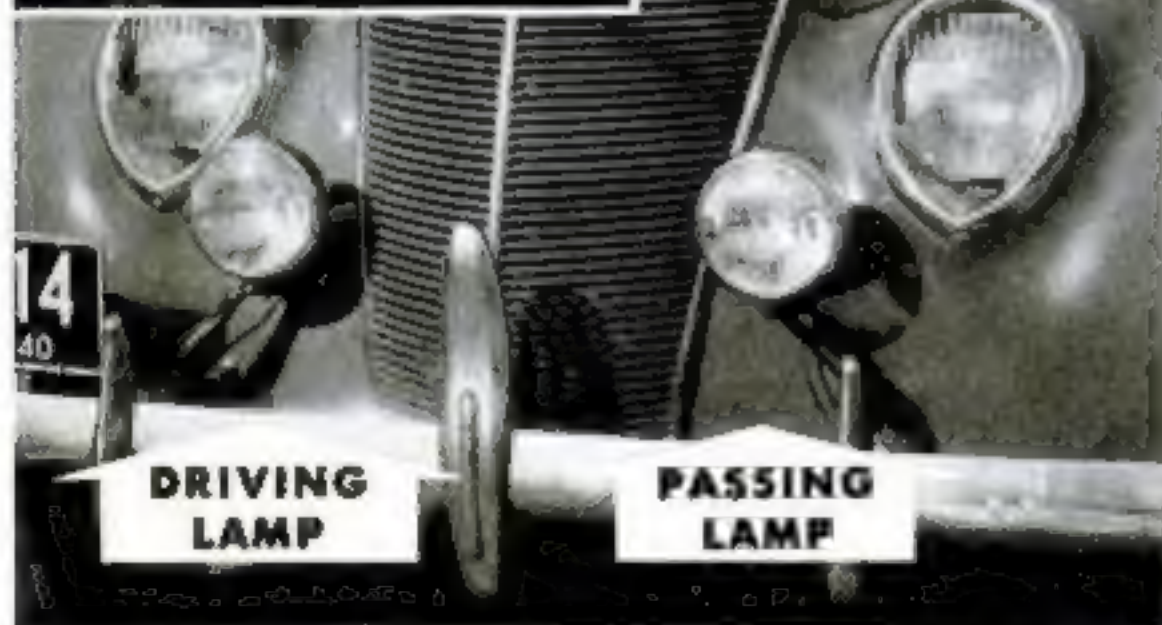
G-E ANNOUNCES NEW INVENTION TO TRIPLE LIGHTING ON OLDER CARS

If you've ever wanted cat's eyes for night driving... if you've envied the safety and comfort of the new Sealed Beam headlighting on 1940 cars... here's what you've been waiting for! Two revolutionary new G-E MAZDA lamps, in auxiliary units inexpensively installed on the bumper at any good garage or service station, work automatically with old headlights to triple the road lighting on average pre-1940 cars. Amazingly efficient, hermetically sealed "All-Glass" construction. No dirt or moisture can "breathe" in to dull the reflectors. And with no inner bulb, the effect of blackening is greatly reduced.

See these new lighting units today. And for your own protection, check these 4 points before you buy:



- 1 **BE SURE** you get 2 units, 1 "driving", 1 "passing".
- 2 **BE SURE** they have "All-Glass" G-E MAZDA Driving and Passing Lamps.
- 3 **BE SURE** units are properly wired, with relays for full efficiency, a cutoff switch for city driving.
- 4 **BE SURE** they're properly aimed to put light where needed for safer seeing.



THE NEW G-E MAZDA Driving and Passing lamps are especially designed to supplement pre-1940 car lighting. Be sure to dim your lights when passing other cars.

The new "All-Glass"
G-E MAZDA AUTO LAMPS
GENERAL ELECTRIC



DRIVING BEAM on average pre-1940 car produces only about 20,000 beam-candlepower before addition of new "All-Glass" G-E lamps.



NEW G-E "DRIVING LAMP" (only 30 watts) adds 35,000 beam-candlepower. Cleaning reflectors and lenses of old headlamps further increases light.



TRAFFIC BEAM of pre-1940 cars, dimmed by dirt and moisture on reflectors, makes passing other cars hazardous.



WITH G-E "PASSING LAMP" added, you get more light far ahead along the right curb and at sides of road where you need it.



THE POSTAGE STAMP THAT WON SUE !



1. I'll never forget Sue's expression. "I love you, Andy," she said, "but I can't marry you until you prove you can amount to something. You've got to earn my respect too!"



2. That hurt! I was angry—until I realized Sue was right. I wasn't *trained* to do any job well. Couple days later I saw an I. C. S. ad. I'd seen them before—but I read this one!



3. It sounded good—too good, almost. But it made sense. So I cut out the coupon, marked the course that seemed closest to my needs, filled in the blanks and mailed it to Scranton.



4. To make a long story short, I signed up for that I. C. S. course. At first, studying was hard—but before long it was *fun*! And my work at the shop improved with every lesson.



5. One day the boss called me in. "Andy, I'm surprised at your work!" he said. "In fact, I'm so surprised I'm making you foreman! Keep it up!" Brother, I was walking on air!



6. Sue and I celebrated our first anniversary last month. I guess that proves the best investment I ever made was a postage stamp! It might be the same swell investment for you!

INTERNATIONAL CORRESPONDENCE SCHOOLS

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POPULAR SCIENCE

Founded 1872

MONTHLY
Mechanics & Handicraft

Volume 137, No. 1

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Published monthly at 353 Fourth Avenue, New York, N. Y., by Popular Science Publishing Co., Inc. Godfrey Hammond, President and Treasurer; R. C. Wilson, Vice President; Raymond J. Brown, Vice President; F. W. Briggs, Secretary. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Dayton, Ohio. Entered as second-class matter at the Post Office Department, Canada. Printed in U.S.A. Copyright, 1940, by Popular Science Publishing Co., Inc. All rights reserved in the United States, Great Britain, and in all countries participating in the International Copyright Convention and the Pan American Copyright Convention. Single copy, 15 cents; Canada, 20 cents. Yearly subscriptions to United States and its possessions, \$1.50; Canada, \$2.00; foreign countries, excepting Canada, \$2.50. Subscribers must notify us of change of address four weeks in advance of the next publication date. Be sure to give both old and new address. The contents of this magazine must not be reprinted without permission. The editors are not responsible for unsolicited contributions, and cannot guarantee the return of such material or insure against its loss. Contributions not accompanied by sufficient postage will not be returned. In presenting numerous stories of new products of applied science, Popular Science Monthly does not underwrite the business methods of the individuals or concerns producing them. To avoid liability for patent infringement, readers should investigate before making, using, or offering for sale any of the devices, machines, or processes described; Popular Science Monthly takes no responsibility. The use of Popular Science Monthly articles for stock-selling schemes is never authorized.

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JULY, 1940

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What's Your Telephone Score?

EVERY DAY many pleasant voices go over the telephone — many, many thousands of them. And it seems to us the number is growing all the time. For most people realize the business and social value of "The Voice with a Smile."

Sometimes what may appear like a gruff or hasty manner is not meant that way at all, but is simply carelessness or thoughtlessness.

Since this is the age of quizzes, how about a short one on some points of telephone usage?



Do You Talk Directly Into the Telephone?

The proper way to use the telephone for best results is to hold the transmitter directly in front of the lips while you are talking.



Do You Speak Pleasantly?

It may be your best friend or best customer. Greet him as pleasantly as you would face to face. Pleasant people get the most fun out of life.



Do You Hang Up Gently?

Thoughtlessly slamming the receiver may seem discourteous to the person to whom you have been talking. It's better to hang up gently.



Do You Talk Naturally?

Normal tone of voice is best. Whispered words are indistinct. Shouting distorts the voice and may make it gruff and unpleasant.



Do You Answer Promptly?

Delay in answering may mean that you miss an important call. The person calling may decide that no one is there and hang up.

"The Voice with a Smile"

can be a real asset. Haven't you often said—"My, but she has a pleasant voice." Or—"I like to do business with them because they are so nice over the telephone."

It's contagious too. When some one speaks pleasantly to you, it's easy to answer in the same manner. Many times a good impression is made by the sound of a voice over the telephone.



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HOW LONG? HOW LONG?
THIS HEART-BREAKING
MONOTONY?
THIS WRETCHED PAY?

"If I Could Only Recover Those Ten Lost Years!"

[The True Experience of a Man Who Almost Enrolled for LaSalle Home-Study Training]

In December, 1921, an American employed with a mining firm in Mexico, clipped and signed a LaSalle advertisement coupon. *But he did not enroll!*

Ten years of silence followed . . . ten years of haphazard jobs, long hours, wretched pay . . .

Then, in January, nineteen thirty two, that silence was broken by a dramatic letter, high-spotted by these words: "Please send the first lessons with the least possible delay, as time is a highly important factor to me in this year of our Lord!"

Through five typewritten pages he recounted the hardships of those intervening years. A really able man, he had moved from one position to another, only to find advancement closed to him for lack of specialized training.

No need here to recite those hardships—though in justice to him it is only fair to say that on four separate occasions he had *almost* enrolled . . . and that on each occasion he had postponed action because of some unexpected reverse seemingly beyond his power to avoid.

"For five months now," so he wrote, "I have been 'on vacation.' Not a chance to take a course now—according to my carefully laid out and conscientiously followed program . . .

"But—supposing I had *chucked* that program at any time in the last 10 years? Supposing I had enrolled, in the face of seeming disaster, even though I had had to borrow the money to do it? Supposing even that I had enrolled only five months ago, at the beginning of my enforced vacation? In all likelihood I could have mastered the training by now. Or I might in the meanwhile have found a congenial and profitable position, thanks

to my increased knowledge. As it is, for all I know, there may be another five months without any position . . . with all sorts of dim prospects . . . and meanwhile I am getting older . . .

"*That settles it! To blazes with further procrastination! To thunderation with my financial program! I've borrowed the money, and I'll borrow some more . . . but I'll do something with my time! This year is going to see a big change in my affairs—and right here is where we start!*"

Send for Free Booklet

These are searching times—and wise is the man who takes full measure of his competition . . . gets the special training that he needs . . . and thus commands the unfolding opportunities of our new-day business world.

If you need to be convinced of those opportunities, forget that you ever read this message. For those opportunities are not for you . . .

But if you are determined to be out in front when men are picked for leadership one year, two years, ten years from now—do not, on your life, risk a day's delay.

Below is a coupon. It will bring you—without cost—books that have led to increased earnings running into many thousands of dollars! Men of action—*hundreds of them*—will use this coupon for their personal advancement. Be one of those men who will steadily win their way to the better-salaried positions.

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I would like to have your special booklet—without any cost or obligation to me—about my opportunities and your success training in the business field I have checked.

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☐ C. P. A. Coaching
☐ Industrial Management
☐ Modern Foremanship

☐ Business Correspondence
☐ Business English
☐ Effective Speaking
☐ Stenotypy



Ask for one of these booklets—or a similar one in your own field of business. They are FREE!

Name _____ Age _____

Position _____ Address _____

"Sure Keeps Models RUNNING FINE!"



MOBIL HANDY OIL

A light, penetrating, non-gumming oil that is excellent for scale models. Lubricates all electric appliances, sewing and washing machines, bicycles, toys. Fine for automobile generators. Prevents rust. Convenient wall bracket free with every can.



FOR CAR ENGINES

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Add it to your gasoline—reaches the engine as a vapor. Special impregnating ingredient protects upper cylinder walls, piston rings and valve stems from rust and wear.

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BY THE MAKERS OF MOBIL OIL

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If you are an average grade school graduate, the average man with High School training earns \$16.30 a week **MORE** than you.

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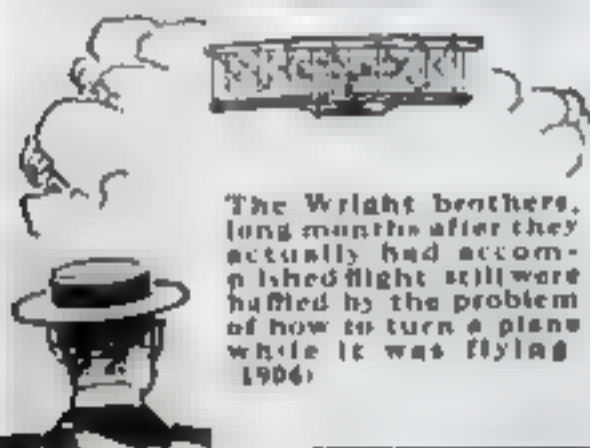
In 1900 . . . Many doctors then practicing were not even high school graduates. High School had not been required at the time they entered medical school.



TODAY—



In 1940 . . . Schools of nursing require high school graduation because most of them are conducted at college level. Progress has made modern nurses' training equal or superior to that available to many old time doctors.



The Wright brothers, long months after they actually had accomplished flight still were baffled by the problem of how to turn a plane while it was flying (1904)

Thousands of schoolboys 14 to years of age know more today about airplane design than the Wrights knew at Kitty Hawk.



In 1900 . . . The High School Graduate was a person of distinction. Only one person in 400 had finished high school.



In 1940 . . . More than a MILLION boys and girls completed high school. Graduates now are commonplace. High school is minimum educational requirement in most lines.



In 1900 . . . Very few even thought of going to college, unless to enter one of the learned professions. The number of college graduates in business and industry was so few that they formed practically NO COMPETITION in the average job.



In 1940 . . . Almost as many are being graduated from college today as from high school 40 years ago. Everywhere in everything you do—in commerce, industry, personal affairs—you are up against the competition of COLLEGE GRADUATES.



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Alice in Wonderland learned: "You must run as fast as you can in order to stay where you are. To get anywhere, you must run **TWICE** that fast."

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Our Readers Say

Then First Thing You Know, They'll Be Playing Bingo

ACCORDING to my morning newspaper, the Germans have been using "magic lantern" projectors on the Western Front, throwing images of supernatural beings on low-lying clouds to scare their foes on the other side of no man's land. This bogey-man stuff won't do any good, but it seems to me that the idea offers possibilities for propaganda to break the morale of enemy troops. Why not use movies, showing propaganda films? They could show a few comedies and cartoons to keep up the interest.—A. McP., Dallas, Tex.

Next to Finding a Match, It's One of Our Chief Worries, Too

HERE is an open letter to some inventive maker of men's clothes. Won't you kindly devise and install in a man's coat, a pocket for a pack of cigarettes? It should be convenient to the right

hand (which rules out the upper left pocket). Perhaps a good place would be just below the holder for small change within the lower right pocket. At any rate, it would save a good many million Americans the annoyance of having cigarettes broken and lost from a half-empty pack

rattling around in a pocket too big for it. Of course, I know that a cigarette case, or any number of clever gadgets now on the market, would solve the problem. But it's simply not human nature for a confirmed cigarette smoker to bother with them.—H. G., Ogden, Utah.

That Pepper Must Have Been Hot Stuff!

A few days ago a very mystifying thing occurred in my home. My mother was preparing the evening meal, and had just finished filling a small glass pepper shaker and put it on the table. She went out into the pantry and a few seconds later she was startled by a loud pop from the kitchen. Reaching the table, she was amazed to see the neck of the shaker broken off just below the cap. The remaining portion was still upright with the broken top beside it. I would be very pleased if any of your readers could give me a solution to this mystery.—A. D. N., Vancouver, British Columbia.

(Continued on page 14)



Another Problem Child for Math-Problem Solvers

THERE'S no doubt about it, numbers can sometimes go haywire, and the letter from W. M., of Medford, Mass., to my way of thinking, points—as he says—to two definite deficiencies in the numerical system, namely, the twin enigmas that result from attempting to divide a quantity by zero, and to extract the square root of a minus quantity. Which puts me in mind of the following, which I herewith offer as this month's problem for your readers to dope out:

Let $x=1$

Then: $1x=1^2$

Subtracting x^2 : $1x-x^2=1^2-x^2$

Factoring: $x(1-x)=(1+x)(1-x)$

Dividing by $(1-x)$: $x=1+x$

But (given): $x=1$

Thus: $x=2x$

Substituting: $1=2$

Now what in the name of Archimedes do you make of that?—N. S., Memphis, Tenn.

AND THEY STILL SAY
 $2+2=4$, HOW COME?



Keeping Up on Popular Science in the Land of the Sphinx

MY OPINION of your magazine is that it is interesting in every part of its contents. Through the numerous pictures I find myself well up to date about all the advances that

are being made all over the American continent, and particularly those that cover radio and photography, all of which increases its value. I wish to take the occasion to offer a small suggestion which perhaps would interest you. That is to include a page or two in your magazine dealing with the latest products of

pharmacy, showing their true value and quality. Also, it would be interesting to see one or two pages on the best method of tuning a radio receiver, what to do when the receiver goes dead, moans, whistles, and so on. I hope



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State Has 425,000 Jobless— but Can't Find Skilled Labor

Second's Harrisburg Screen
HARRISBURG, Jan. 23.—With private industry to trade say up
425,000 unemployed on its own position during the last depression
waiting lists, the State Unemployment Service disclosed today
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 11

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Our Readers Say (CONTINUED)

these suggestions enable you to increase your circulation in Egypt, and toward that goal or all others, I am entirely at your service.—V. H., Cairo, Egypt.

He'll Find One Way of Doing It by Turning to Page 131

MAYBE some of those mechanical-minded readers can tell me if this idea would be practical. I've been pondering on it for quite a

HEY, BUSINESS IS BUSINESS—I'LL FILL ANYTHING!



while. Why couldn't a car be fixed to go in water not over three feet deep? The carburetor could be raised up higher, the spark plugs, distributor, and other electrical fixtures properly insulated, and the gas tank and exhaust pipe also raised higher. I admit this sounds a mite "teched," but I think

that it could be adapted for swamp use on a chassis that has been stripped and fixed over. The height of the gas tank could be adjustable, because no self-respecting garage man wants to climb up four feet just to "fill 'er up." What do you think of the idea?—C. M. S., Lockport, N. Y.

A Couple of Articles That Were "of Great Value to Firemen!"

AS AN instructor in the fundamentals of fire fighting in the Commonwealth of Pennsylvania, permit me to congratulate you on two fine articles in the April issue. One was "Make-Believe Fires," the other was "When You Climb Don't Look Up." They are of great value to firemen.—J. R. M., Bareville, Pa.

WHICH WAY DO I LOOK GOING DOWN?



He's Tuned Right In to That Page of Radio-Cabinet Ideas

IT STRUCK me that the page of "Cabinet Ideas for Radio Builders" in a recent issue was particularly fine. As a matter of fact, the room pictured at the top of the page gave me just the idea I've been looking for and I'm going to follow it when I panel a sun porch on my house this summer, making radio-phonograph and speaker cabinets out of the same wood that I'll use for the paneling.

(Continued on page 16)

Much obliged for the inspiration, and let's have more pages like it.—S. P. R., Norfolk, Va.

Smashed-Atom Smashers Will Be the Next Step

THERE'S really no need for Y. R. to worry as to what will be left after the atom is "busted."

HEY, I HAVEN'T ROOM FOR ANY MORE CREASES IN MY FOREHEAD!



Not only is tremendous energy loosed, but an entirely new atom is left. This atom is of a new element still containing plenty of power. Breaking a gallon of gasoline down, element by element, into helium would release millions of foot pounds of energy and still leave an equal volume of helium. The next thing to be figured is

the harnessing of the helium's energy, which will come. Give us more articles like "Giant Atom Gun."—G. L. W., Dayton, Tenn.

Thanks, We'll Take Ours Processed into Beefsteak

WHILE resting this evening after a session with my lawn mower, I read in the newspaper that scientists have discovered great food value in grass. It seems that a few pounds of the stuff, properly processed and made into pancakes and other dishes, would provide human beings with as many vitamins as all the vegetables that the average person eats in a year. If true, this is heartening news to all slaves of the mower. Cutting the grass always seemed to me a futile business, like washing your face, no sooner do you get it done than you have to do it again. But if a fellow can combine his lawn mowing and his vegetable gardening in one operation, it will be worth while. Just one thing worries me: I wonder what grass pancakes taste like.—M. M., Dearborn, Mich.

SWELL, YOU OUGHT TO TRY IT!



In Other Words, the Skier Jumped to the Right Conclusion

C. H. N. may set his mind at rest about his friend's skiing friend. He's perfectly safe and undoubtedly getting set for some fancy high diving this summer, because flying through the air seems to be his line. The skier landed more than fourteen feet beyond the crevasse,



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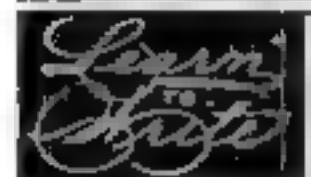
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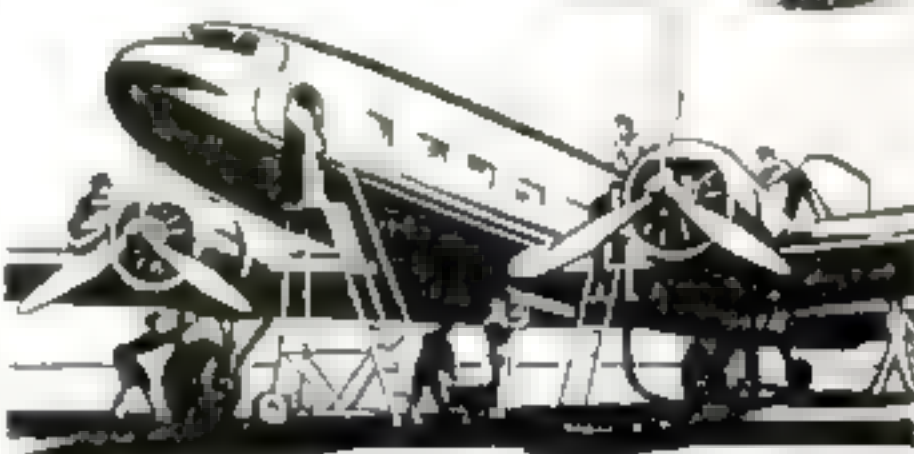
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Name Age

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Our Readers Say (CONTINUED)

because it takes a falling object about one and a tenth seconds to drop twenty feet, and in that time the skier covered more than sixty-four feet. To put it another way, his "factor of safety" was about 1.28!—M. C. H., West Roxbury, Mass.

We'll Worry Along Somehow with the Noises We've Got

SORRY, J. P., of Brooklyn, but your idea for eliminating noise with an audio-amplifying apparatus, while sound (no pun intended), is not readily practical. Here's why: At any given point, the noise level is continuously variable. The noise pulses that make up the racket change in intensity, phase, periodicity, and percentage of harmonic content, not to

THAT IDEA IS JUST
A LOT OF NOISE—
OOPS, SORRY!



mention frequency. This would require the continual variation of the local pulses which we would use to buck the unwanted, incoming noise pulses. Then, too, the incoming noise pulses beat with each other, giving rise to a very great number of secondary pulses. Imagine

what you would run into when you had eight or ten different sources of noise, all with their own complex wave shapes to be analyzed (which analysis, by the way, is not the easiest thing in the world, either). I think you will agree that the solution to noise is not by production of local pulses to buck the incoming ones.—C. C. M., Franklin, Pa.

It's Been Used Near Kitchen Fires for a Good Many Years Now

IN AN article on page 126 of your May issue, Gus Wilson extinguishes a car fire by throwing a big paper bag of flour on it. This may be done at times, but flour mixed with air is a dangerous explosive. He had better use dust, salt, soda, snow, or almost anything else.—G. J. H., Chicago, Ill.

SURE would hate to be around Gus's oil fire when he tries to put it out with flour. I had fun as a boy making explosions with the same stuff.—G. B. D., Niagara Falls, N. Y.

With Sea-Breeze Windmills Pumping the Water Along?

YOUR recent article on Uncle Sam's antarctic domain gave me a bright idea. Why couldn't we have W.P.A. workers lay several enormous pipes from Florida to Antarctica, and have the warm water of the Gulf Stream which travels by Florida run into the pipes

and hence to Antarctica to make it a warm paradise?—H. I. C., Dallas, Pa.

Does the Sun's Temperature Change Our Weather?

SOME time ago I heard the question "What caused the great glaciers of the Ice Age?" asked on a radio program. The answer given was that the sun, growing hotter, caused more evaporation, which in turn caused more precipitation. The ice formations at the poles grew larger with this excessive precipitation until, under the enormous weight, they gradually began to move toward the equator. From that I conceived the idea that many of the extreme weather conditions of today—flood, drought, and heavy snowfall such as New York State had this winter—are caused by comparatively small and brief changes in the sun's temperature. A lower temperature of the sun would cause less evaporation, less rain—hence the drought. A higher temperature would increase the evaporation and precipitation—hence the flood or, in winter, the heavy snows. My friends say I'm crazy to even think of such a thing.—B. L. C., Trumansburg, N. Y.

HOW CAN A WARM-
HEARTED GUY LIKE ME
BE BLAMED FOR ICE
AND SNOW?



Your Forefinger, Not the Dollar, Hits the Pencil

CAN you, or anyone in the army of POPULAR SCIENCE readers, describe how a folded dollar bill can be used to break an ordinary lead pencil? I saw the stunt done years ago.—P. E. T., Tuckahoe, N. Y.

Not a Bad Idea, B'Gosh! Let's Have More Like It

AS A new subscriber to POPULAR SCIENCE, I am finding the magazine of great interest and well worth the price. Since you are laudably acting as a clearing house for the ideas of readers, it may be fair to ask when the automobile manufacturers will apply pneumatic power to the operation of rear windows in closed cars, all from a dashboard control?—A. H. S., Jr., Clinton, Conn.

HOW ABOUT THOUGHT
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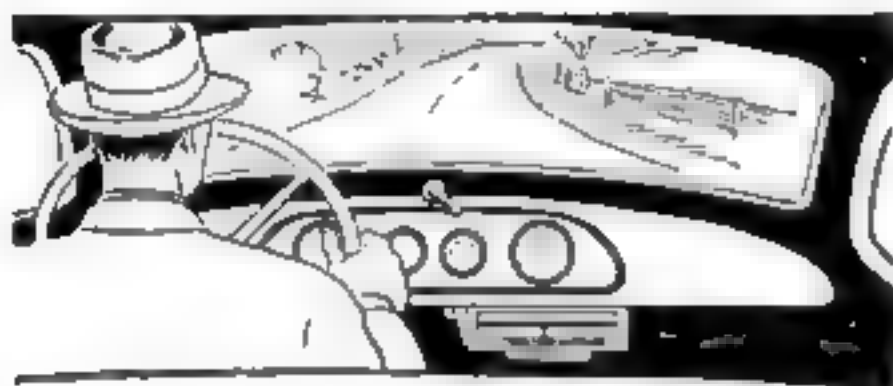
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With the Inventors

MOTORISTS touring unfamiliar country should have little trouble finding their way if their cars are equipped with an ingenious map mechanism invented by Justice R. Maley and William S. Carver, of Portland, Ore. Placed on the car dashboard,



a metal casing houses a strip-shape highway map mounted on reels so that a portion of it is exposed through a window in the housing. The reels are geared to the car speedometer so that the map moves across the opening according to the speed of the car. Once accurately set, an adjustable pointer indicates on the map the exact location of the automobile as it moves along the highway. In addition to the route number, the moving map bears information on landmarks, service stations, crossroads, detours, picnic spots, and other points of interest. When the driver turns onto another highway, it is a simple operation to remove the map and insert another covering the

new road . . . THE YEAR 1940 marks the 150th anniversary of the U. S. patent system . . . AN ELECTRIC SWITCH THAT GLOWS with a blue light when off and with a red light when on, is a recent invention credited to Alfred W. Barber, of Flushing, N. Y. Of the mercury type, the switch has a transparent knob divided into two compartments. When

the knob of the ingenious fixture is in the off position, mercury vapor in the upper compartment glows with a blue light. When the knob is flipped to the on position, neon vapor in the lower compartment glows with

(Continued on page 20)

a red light . . . THE MODEST FIRST HOME of the U. S. Patent Office, shared jointly with the Post Office Department, was the only public building in Washington, D. C., not burned by the British in the War of 1812 . . . A NOVEL BEVERAGE SPOON developed by Gustav Blomqvist, a Swedish inventor, holds a single cube of ice. The cube-shape bowl of the spoon is filled with water and then inserted in the freezing compartment of a mechanical refrigerator. When a single cube is needed to ice a drink, it is therefore unnecessary to remove a whole tray of ice cubes, but merely one of the ice-cube spoons, which can be inserted in the glass and used for both stirring and icing . . . TODAY THE U. S. PATENT OFFICE requires eight acres of floor space, or about one third of the huge Department of Commerce building, one of the largest office buildings in the world . . .



BUTTONS OF SELF-LUMINOUS, phosphorescent material are built into a novel dog leash and harness invented by Helen De Sanctis, of New York City. When walking the dog at night, the glow of the leash will make it less likely that passersby will accidentally become entangled in it, the inventor states. Also, she adds, the glowing harness will make it easier to locate a dog running loose



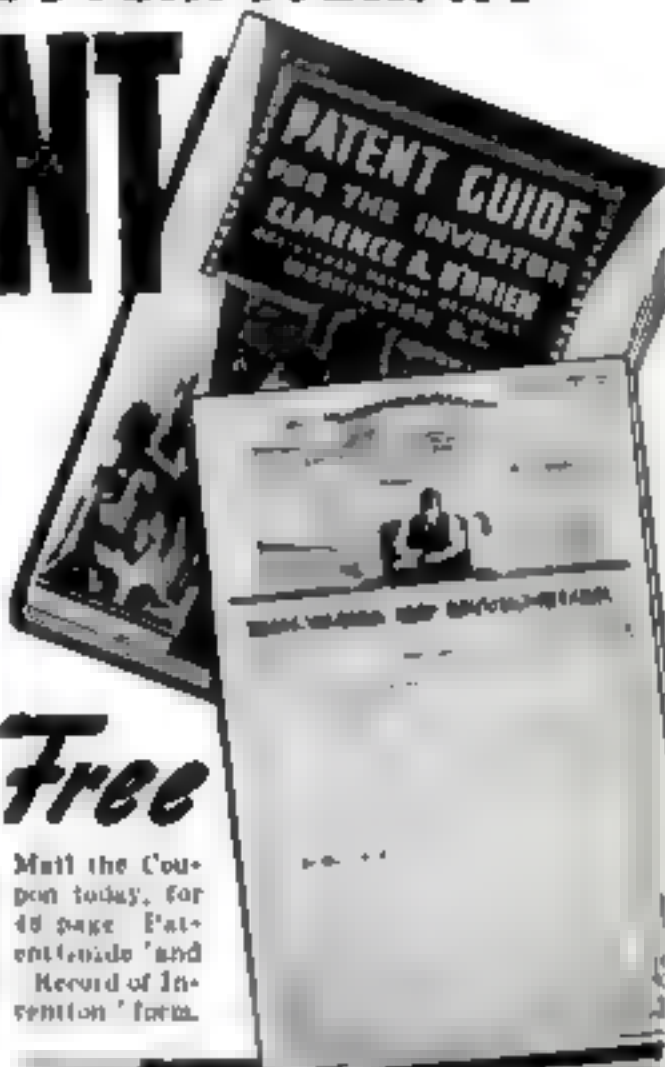
at night . . . ONE EXAMINER and three or four clerks formed the complete staff of the Patent Office when it was first established. The staff now numbers more than 1,300 . . . BULLETS WILL BOUNCE HARMLESSLY off a novel military helmet, according to its in-

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With the Inventors

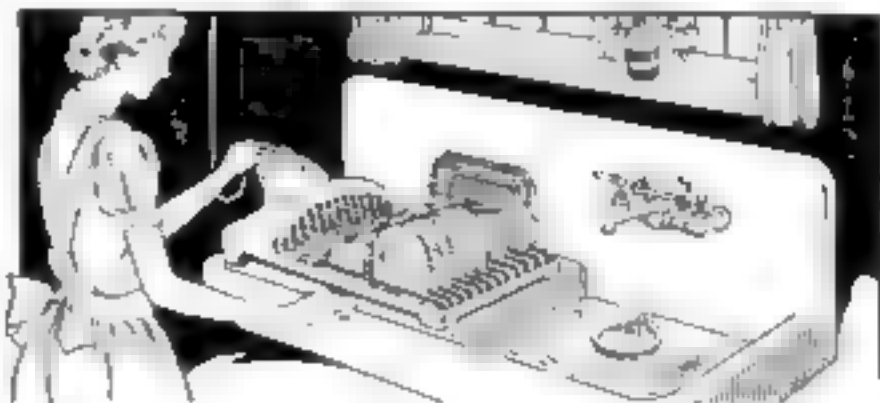
(Continued from page 18)

ventor, Percy L. Crosby, of McLean, Va., a well-known cartoonist and writer. Made in two parts, the steel helmet has a conical crown held to the brim by means of a circle



of coil springs. When hit by a bullet or a piece of shrapnel, the crown is designed to recoil, cast the bullet aside, and then spring back into place on the wearer's head... **TOTAL NUMBER OF PATENTS GRANTED the first year the U. S. patent laws were in effect: Three... DISHES ARE DRIED QUICKLY and without wiping by an electric blower device designed by**

Gilbert J. Gates, of Arlington, Va. The apparatus consists of a small electric fan mounted at one end of a wire rack designed to fit on the drying surface beside the sink and hold dishes in an upright position. The stream of air from the blower quickly dries wet dishes as they are removed from the dish water and placed in the rack... **FROM 1790 until just before the Civil War, approximately 10,000 patents were issued in this country. About five times that number are now issued annually... ONE SOLUTION TO THE PROBLEM of preventing automobile thefts is offered by W. T. Mead, of Los Angeles, Calif., who proposes a license-plate holder fitted with a key-operated shutter that can**



be moved down over the license. When a driver parks his car, he turns the key, which slides over the license plate a shutter bearing the legend: "If in motion, this is a stolen car." When the motorist returns to his car, it is a simple matter to insert the key

(Continued on page 22)

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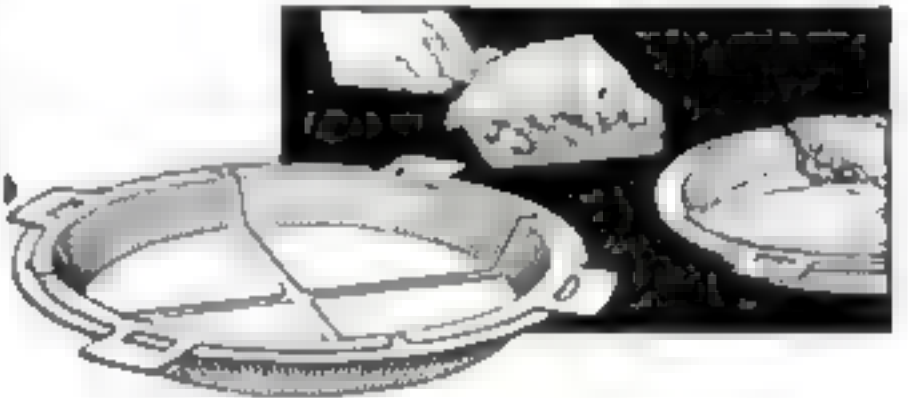
With the Inventors

(Continued from page 20)

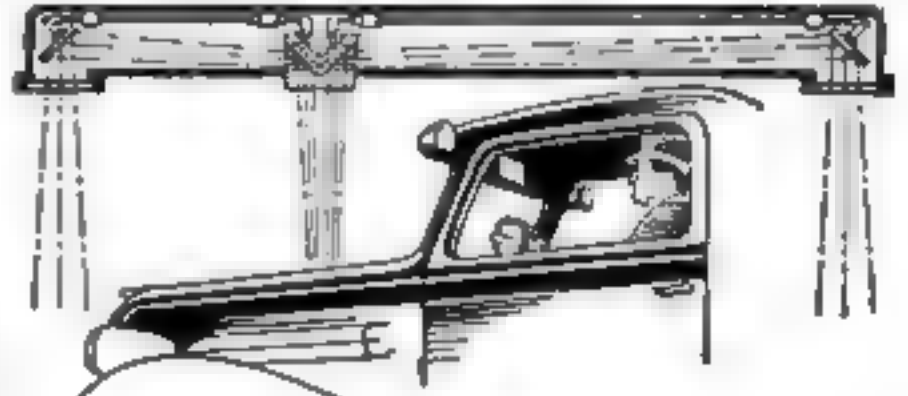
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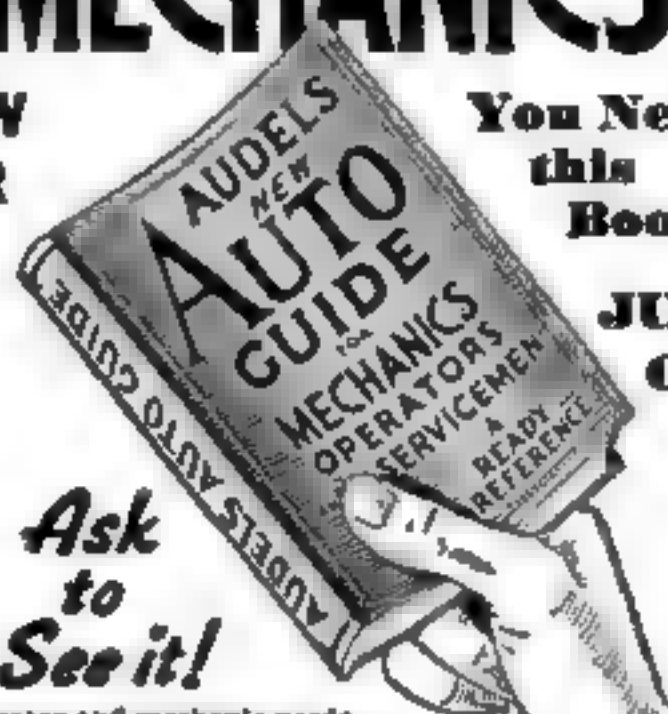
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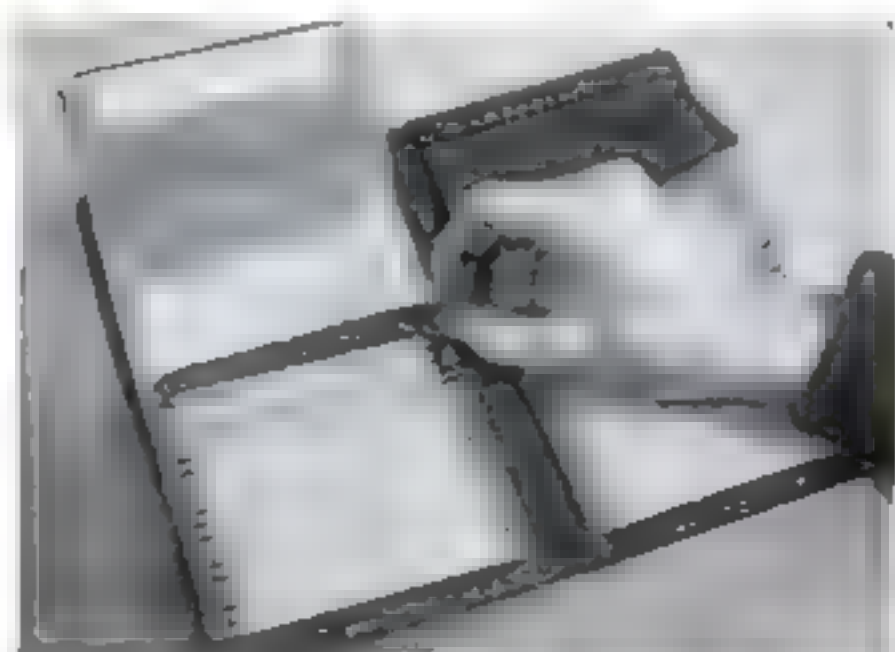
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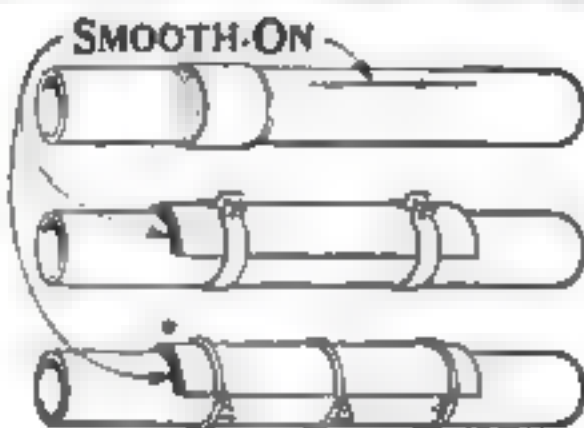
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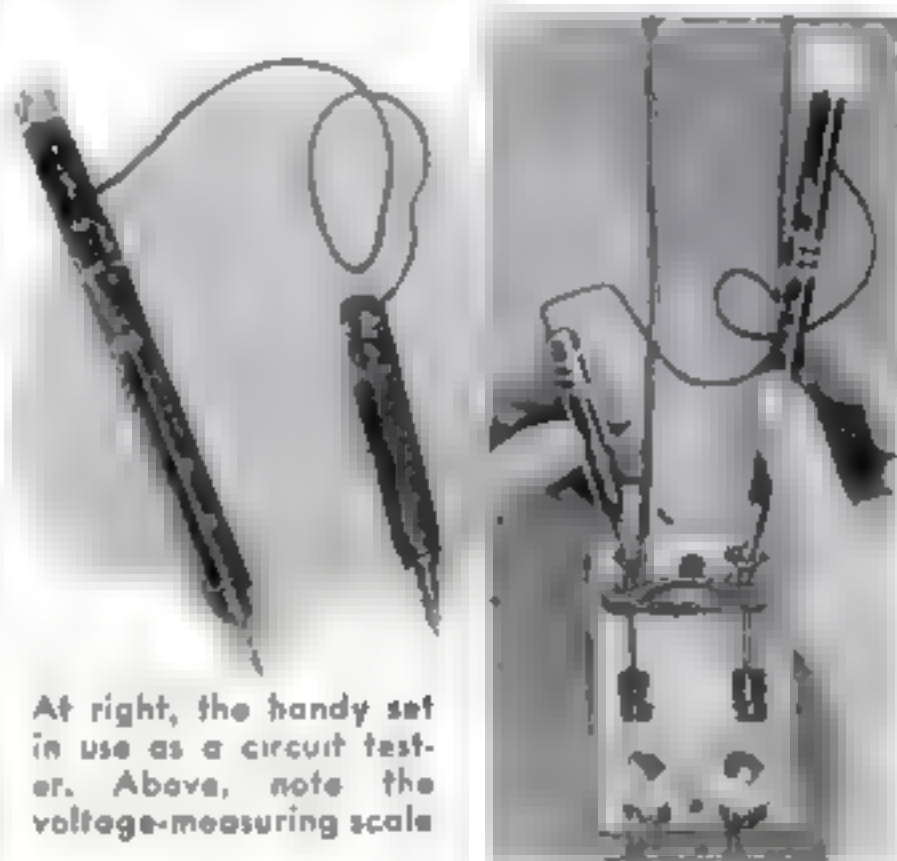


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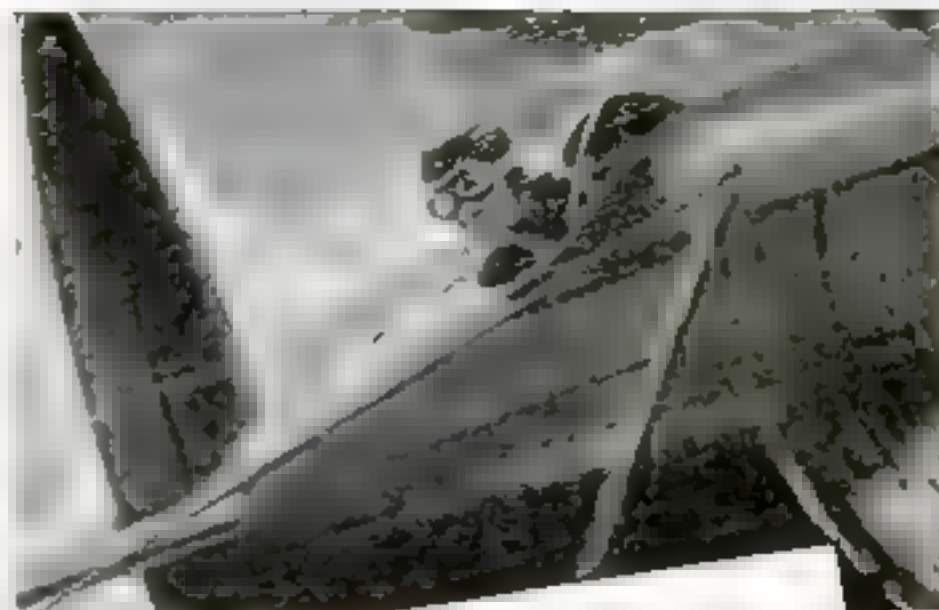
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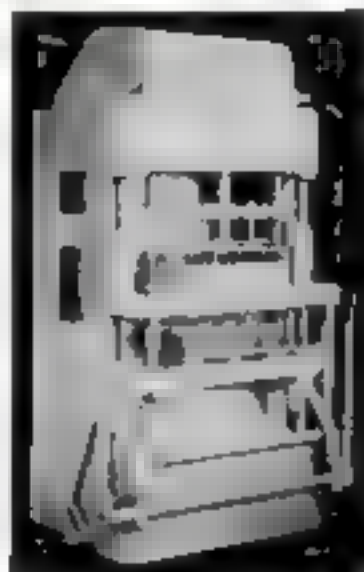
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Q.—CAN you give me a formula for a solution that will restore the original color to brick walls that have become bleached, discolored, and dirty?—C. E. B., Boston, Mass.

A.—DISSOLVE one ounce of glue in a gallon of hot water to which has been added a piece of alum the size of an egg, half a pound of Venetian red, and one pound of Spanish brown. Apply the mixture to the surface of the brick with a brush.

Cracks in Concrete Floors

C. G. H., COWETA, OKLA. Cracks in concrete floors may be filled in the following manner: Soak an ounce of glue in three quarts of warm water. When the glue has dissolved, add a pound of flour, one tablespoonful of borax, and one tablespoonful of alum. Stir shredded newspapers into this solution to form a puttylike mass and ram this into the cracks with a hammer and a blunt chisel.

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L. C., BROOKLYN, N. Y. Grease spots on wall paper often will yield to a pad of blotting paper pressed against the wall with a moderately hot iron. Afterward, dampen the spot, sprinkle on a little powdered pipe clay, or fuller's earth, allow it to dry, and then remove it with a soft brush.

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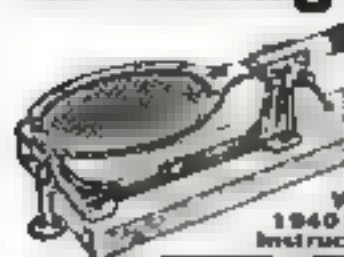
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In this issue,

POPULAR SCIENCE MONTHLY inaugurates a brand-new arrangement of its editorial pages. To make it easier for you to find the material that interests you most, the various articles have been carefully grouped according to their subject matter. The classifications include aviation, automobiles, home and farm, craftwork, and more than a dozen others. With this new grouping, POPULAR SCIENCE MONTHLY is provided with an easy means of ready reference that makes it even more valuable and readable than before. If you like this new arrangement, please let us know.

RAYMOND J. BROWN, *Editor*

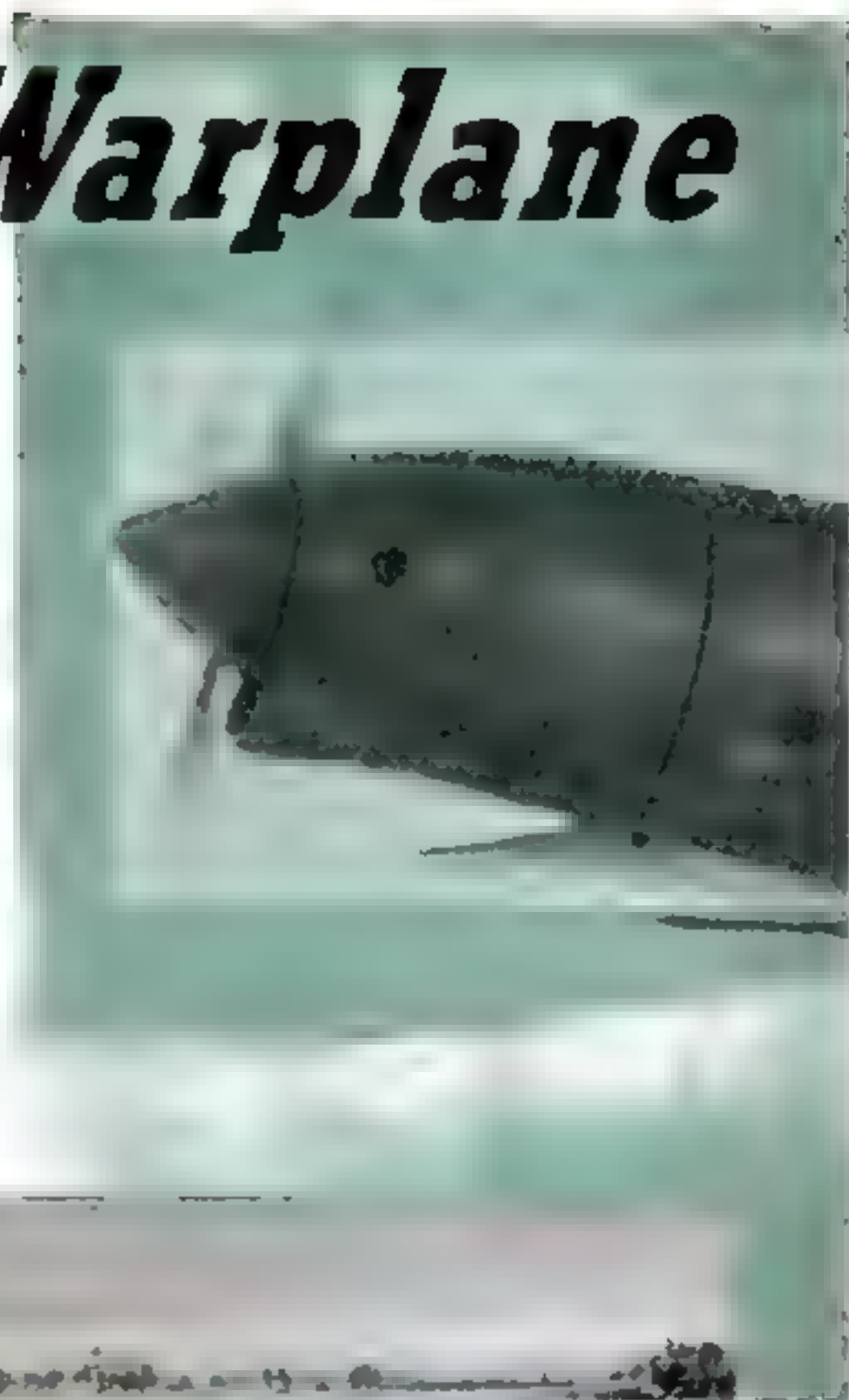
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Newest Warplane

400-MILE-AN-HOUR FIGHTER
IS PUT THROUGH ITS PACES
BY A SKILLFUL TEST PILOT
BEFORE IT IS TURNED OVER
TO THE MEN WHO WILL FLY
IT IN BATTLES IN THE SKY

By
John E. Lodge

Mechanics grooming the new Vultee Vanguard interceptor-pursuit plane for a tryout flight from a California field



Tries Its Wings



Latest challenger of the sky—the Vanguard in flight. Note its sleek, streamline design

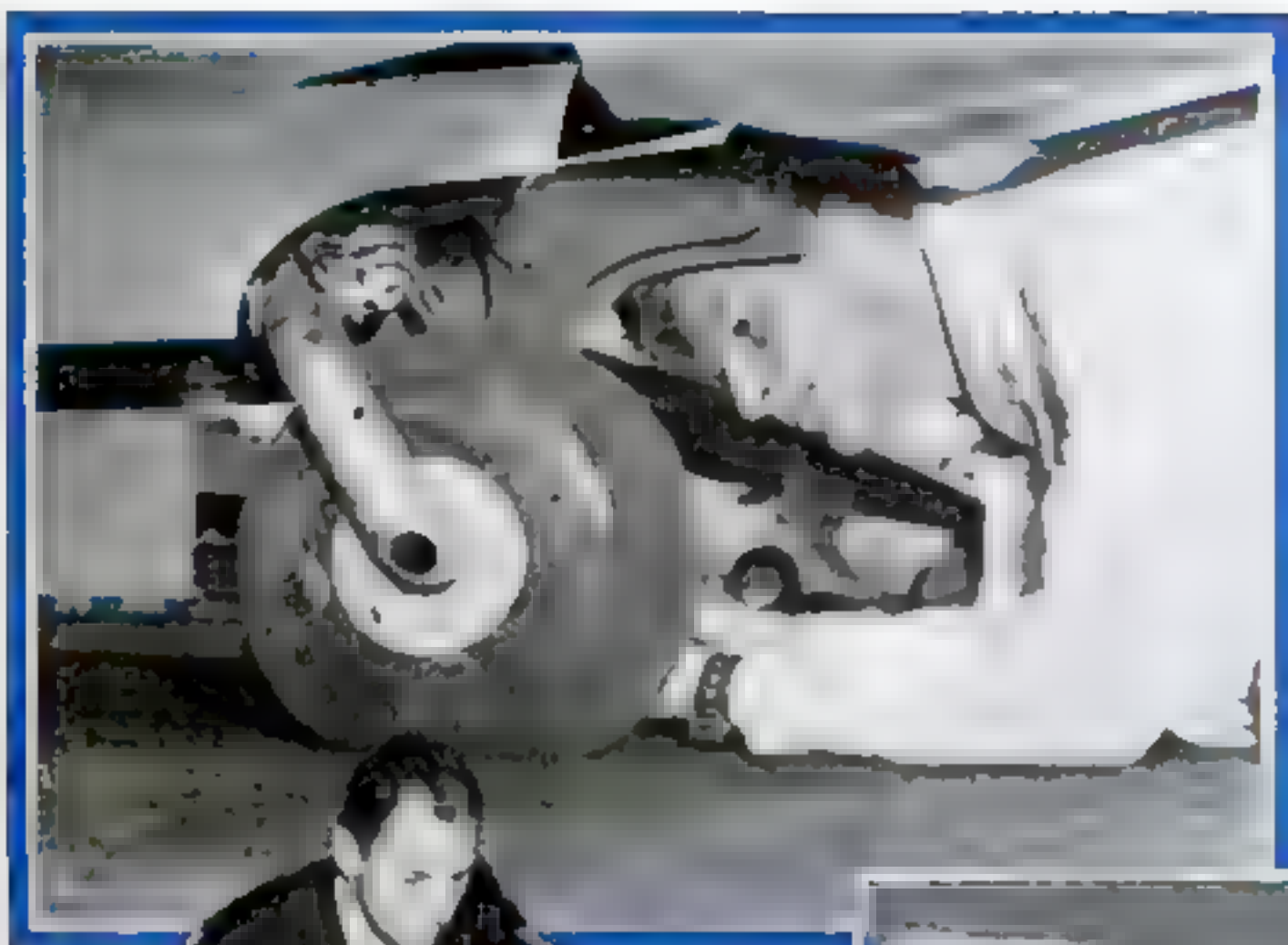
JOHNIE WAGNER sucked at his oxygen tube and began talking into the mouthpiece of a recording device "Altitude 15 000 Stabilizing at full throttle for speed run. . . ."

Less than five minutes before, Johnnie had lifted the new Vultee "Vanguard" from the narrow runway below, climbing some 4,000 feet a minute. Now he was streaking like a scared rabbit across the sky, hitting close to 400 miles an hour in the new interceptor-pursuit fighting plane, guiding the 1,200 roaring horses packed into its bullet nose through a flight he hoped would be as smooth as a table top.

For Johnnie that day was testing the newest warplane. She was not a souped-up racer intended to compete for speed laurels, but

This tube mounted on a wing helps to measure the air speed

a production model which in coming weeks may be spitting lead from four machine guns across the Western Front. Upon her ability to rise nearly eight miles, and to roll, loop, stall, and recover for chases through the sky faster than other warplanes in her class, fighting pilots shortly may depend for



In flight, the tail wheel at left is retracted into the fuselage and the hole is covered by metal doors. This feature alone adds six miles an hour to the speed of the new warplane

Below, flush riveting makes the wings and body as smooth as silk and cuts air drag by fifteen percent, for still more speed



In test flights, a camera records instrument readings in this special case



800-foot run and swings on its way toward the stratosphere, she resembles a graceful flying fish

Long before the Vanguard left the blueprint stage, engineers were figuratively whittling down protuberances, smoothing the skin, lengthening the nose, even tucking the tail wheel into the narrow fuselage. From nose to rudder and across the tapered wings, speed has been built into this plane, largely by elimination. To overcome the resistance of a radial, air-cooled engine, the nose was built forward nearly two feet and brought to a taper at the hub of the triple-blade propeller. An air scoop, retracted from the cockpit when flying at high speeds to reduce drag, permits cool air to circulate around the engine and come out at the side. Similarly, more air is pulled into the belly of the fuselage and circulated through an inverted "U" around the oil-cooling system.

As engineers moved back through the structure, they continued whittling at little things whose absence would add miles to the plane's top speed. Flush riveting, which made the skin smooth as silk, reduced drag

their lives in grim but thrilling combats.

It takes careful flying and a delicate touch to keep a ship zipping six miles a minute on an absolutely level path, varying vertically no more than twenty feet, while recording flight data and observations on a wax cylinder, snapping pictures every five seconds, and watching closely more than 100 instruments and devices in the crowded cockpit.

Recently I watched the Vanguard as she demonstrated qualities of climb, maneuverability, and speed once thought impossible in a warplane. This ship gives no impression of sensational speed when you see her standing alongside a hangar, cockpit covers open, side panels off, and the three wheels extended, leaving gaping holes in the wings and fuselage. Yet, when the ship pulls sharply from the field at Downey, Calif., after an



Flying lights are housed behind streamline covers at wing tips. Side panels of the fuselage can be lifted off easily, as pictured below, for emergency repairs



The pencil points to one of the duralumin ridges that set up air currents on the wings to correct stalls

fifteen percent and raised speed nearly twenty miles an hour. Removing the usual sanded walkway on the wings gained another six miles.

At last, when W. C. Rockefeller, Vultee's chief of aerodynamics, had completed the engineering tests and calculated the plane's performance, "within three percent," the ship was turned over to Johnnie Wagner. Learning how to climb the swift job to fighting altitude without burning up the hard-working engine, and get there faster than any pilot yet has gone up, requires repeated tests. You don't simply pour on the "soup" and point her nose toward the clouds, if you want to get there in one piece and save the costly engine for another flight.

Starting at the mile level, Johnnie piloted



the trim plane through a series of saw-tooth climbs and descents, going up and down in 2,000-foot steps. Now he climbed while flying 140 miles an (Continued on page 220)



New Airplane-Engine Timer Speeds Mechanics' Work

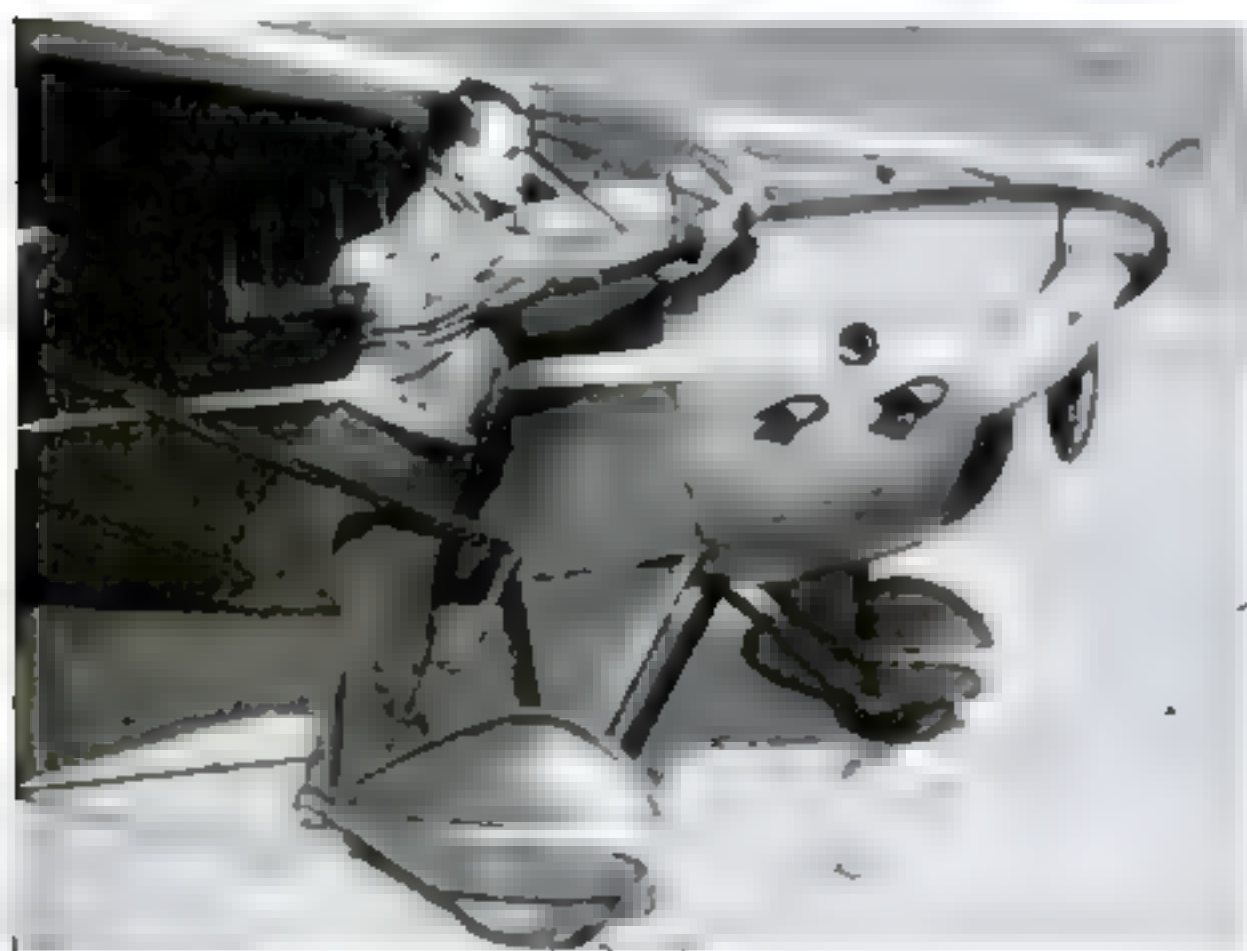
TO AID mechanics in timing airplane motors, an ingenious new instrument fits on a propeller hub. The device consists of an aluminum dial marked off in degrees, and a pointer weighted at the bottom so that it always remains in a vertical position. With the instrument dial adjusted so that the pointer is at zero, the propeller is then moved through the precise number of degrees to bring the motor's pistons into the desired position for timing both the ignition system and the valves.

Safety Scaffolding Is Easily Erected

MOUNTED on castor wheels, a mobile safety scaffolding for mechanics working on airplanes, tested recently by U. S. Coast Guard aviation authorities, can be assembled to any convenient working height. Two men can erect six five-foot sections of the tubular-steel scaffolding in thirty minutes.



Made of welded steel tubing, the scaffolding is strong in spite of its light weight



Starter Is Handy to Throttle of Light Plane

EASE and safety in starting the motor are two features of a new light plane. In this two-place, side-by-side model, the motor is started by turning a hand crank instead of spinning the propeller. Moreover, the crank is placed at the side of the engine so that the pilot can start his motor and at the same time reach into the cockpit to control the throttle. This makes it possible for the flyer to start his motor safely without assistance.

How the pilot may reach inside the cockpit to the throttle as he cranks



Fighting Plane Climbs a Mile a Minute

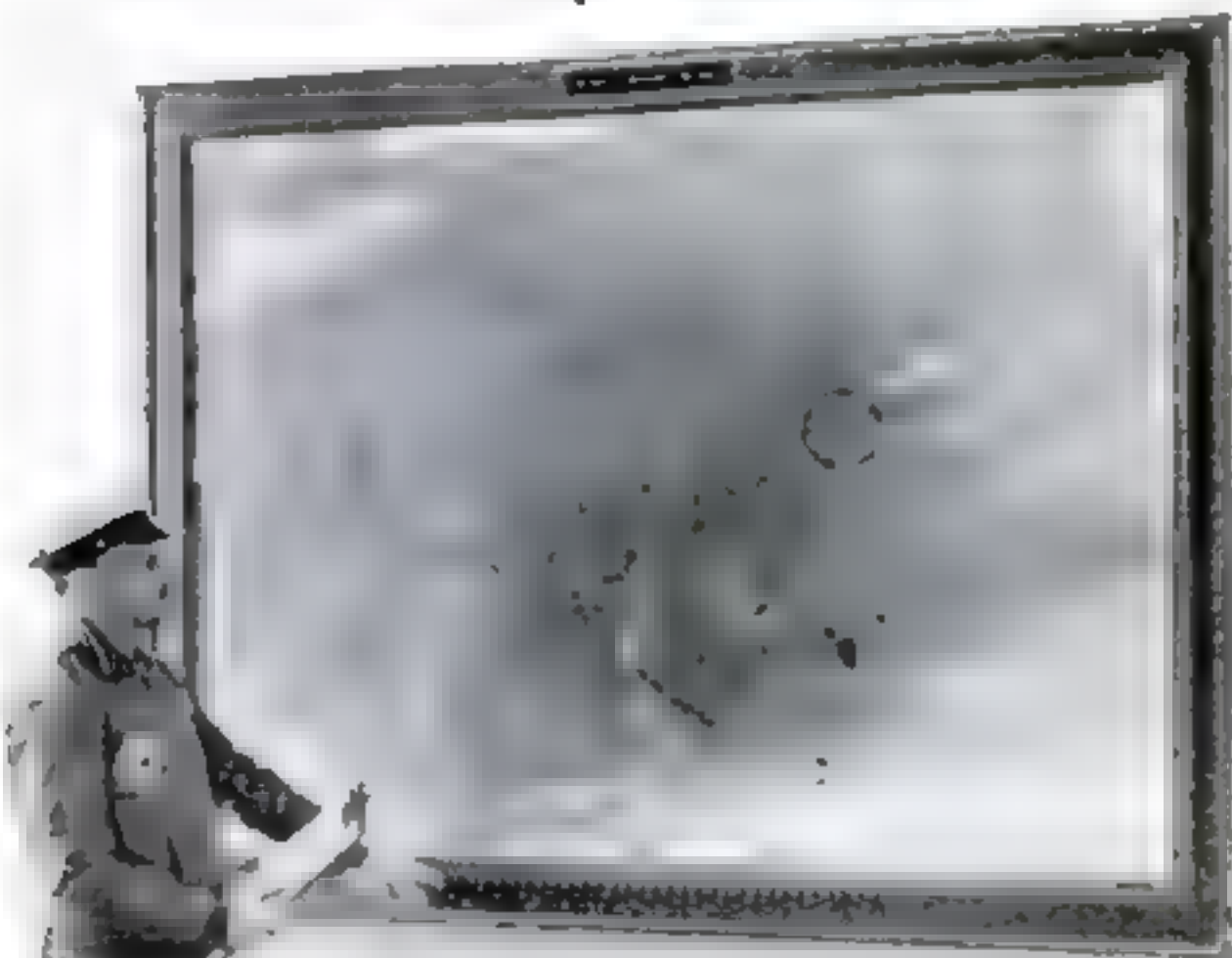
New Curtiss-Wright interceptor in the air and, at the right, on the ground. Note the fairings that cover the wheels in flight



WITH a rocketlike climb of a mile a minute, a new interceptor monoplane, designed by Curtiss-Wright engineers, is a valuable aid in defense against raiding bombers. Pulled by a triple-bladed steel propeller and with the landing wheels folded into streamline fairings beneath the wings, the new machine has a straightaway speed of more than 300 miles an hour. Tests at a St. Louis, Mo., field recently showed that it can climb, at what is said to be the fastest rate ever at-

tained by an airplane, to a ceiling of 36,200 feet. Like other new high-speed, American-designed fighting planes, it will be produced in quantity for use in Europe.

Electric Map Shows Weather Conditions



ELECTRIC lights on a huge weather map at the Naval Reserve Air Station in New York City, enable a pilot to see at a glance the weather conditions at any airport in the region. Each airport is represented on the map by a single bulb, the color of which can be regulated by means of levers beneath the map. Each lever operates an individual slide connected to the back of one of the bulbs, by which the color of the light can be made green, white or red, depending on the conditions. A green light means that weather at the indicated airport is good. White means it is possible to land by instruments, and red means the weather is too bad to attempt a landing.

Colored lights tell whether landings are possible at various fields

Thrills of



By Lieut. Comdr.
DON F. SMITH

THE author, at present in command of the Floyd Bennett Field Naval Reserve Base in New York City, has had more than 5 000 hours of flying in every type of Naval aviation squadron. Of his twenty-three years in the Navy, nine have been spent piloting swift pursuit ships and powerful dive-bombers from the decks of Uncle Sam's giant floating airports, the aircraft carriers.

One of Uncle Sam's floating airports, the U.S.S. "Saratoga." As many as ninety planes may be carried on a vessel like this

the Flying Sailors

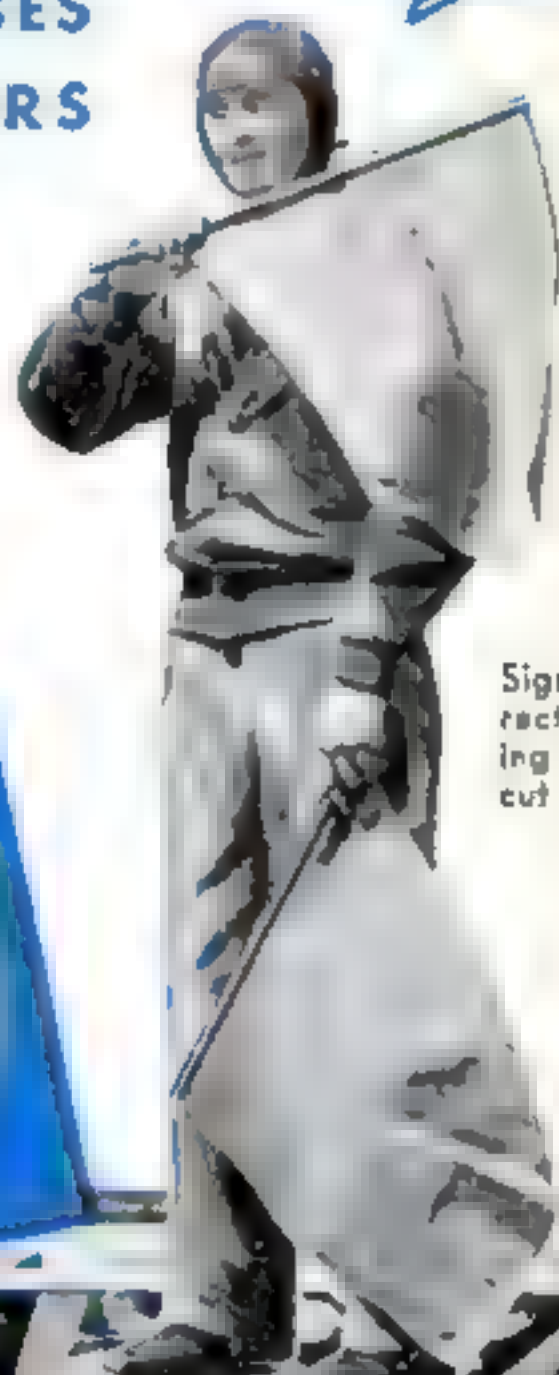
A VETERAN NAVY PILOT DESCRIBES LIFE ON OUR AIRCRAFT CARRIERS

THE reddish-brown deck streaks to the rear. Open water flashes under your wings. You are climbing. That, for a pilot aboard one of those hornets' nests of the sea, the aircraft carriers, is the beginning of adventure.

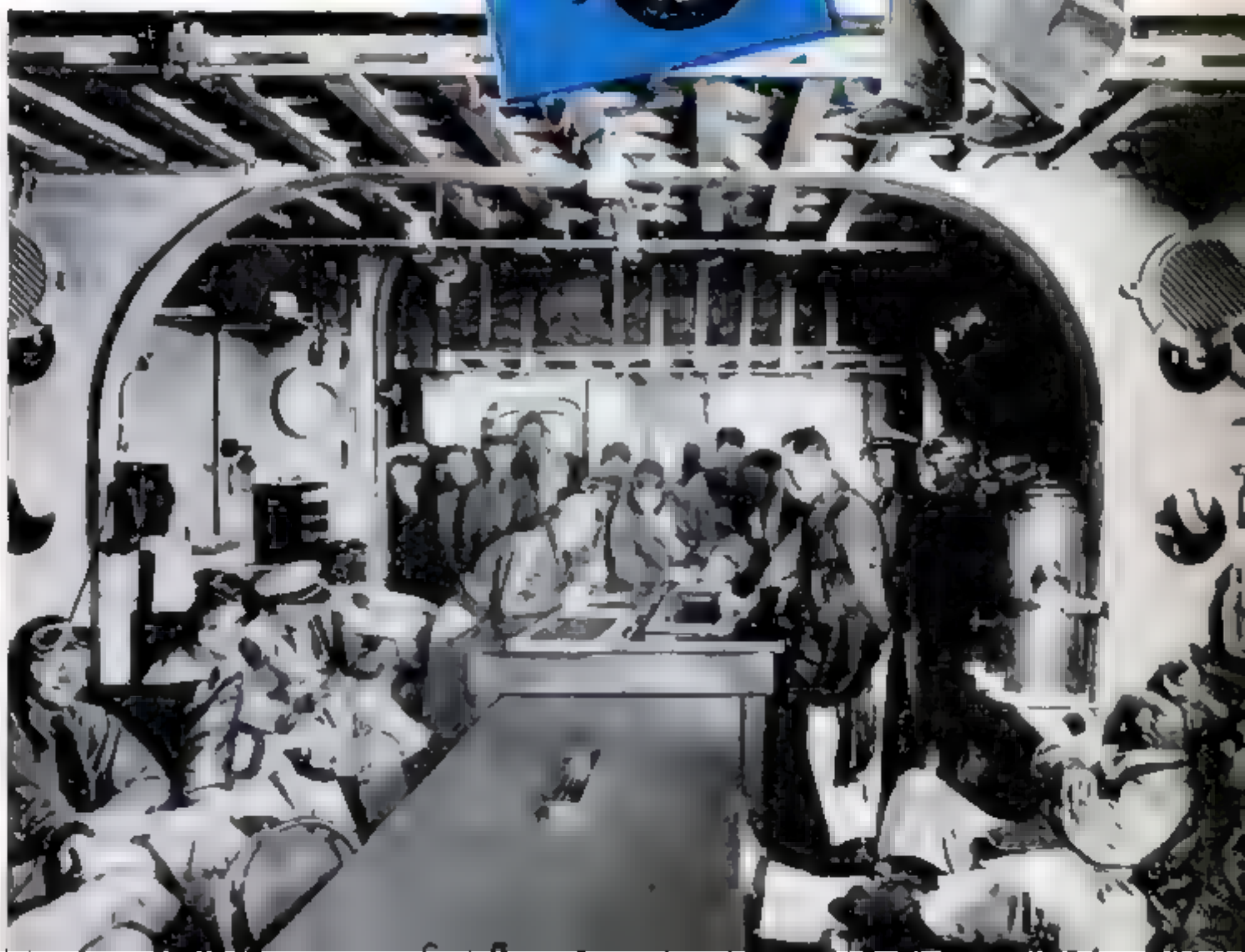
One thrill which occurred off Panama, stands out in my memory. I had lifted a T4M torpedo plane from the million-dollar teakwood deck of the *Saratoga*. My mission was simple. I was to fly to another vessel, blank it off with a smoke screen, and return to my floating airport. Just as I slanted down above my objective, thirty minutes later, a connection at the smoke tank snapped. Choking, blinding billows of chemical vapor swirled around the plane.

Coughing and gasping. I kicked over the rudder. The ship skidded to the right; the trail of vapor veered to the left. I gulped.

Flyers waiting for orders. At right the insignia of a scouting squadron.



Signalman directs a landing pilot to cut his motor





Landings provide never-failing thrills. Cables stretched across the deck stop a rolling plane

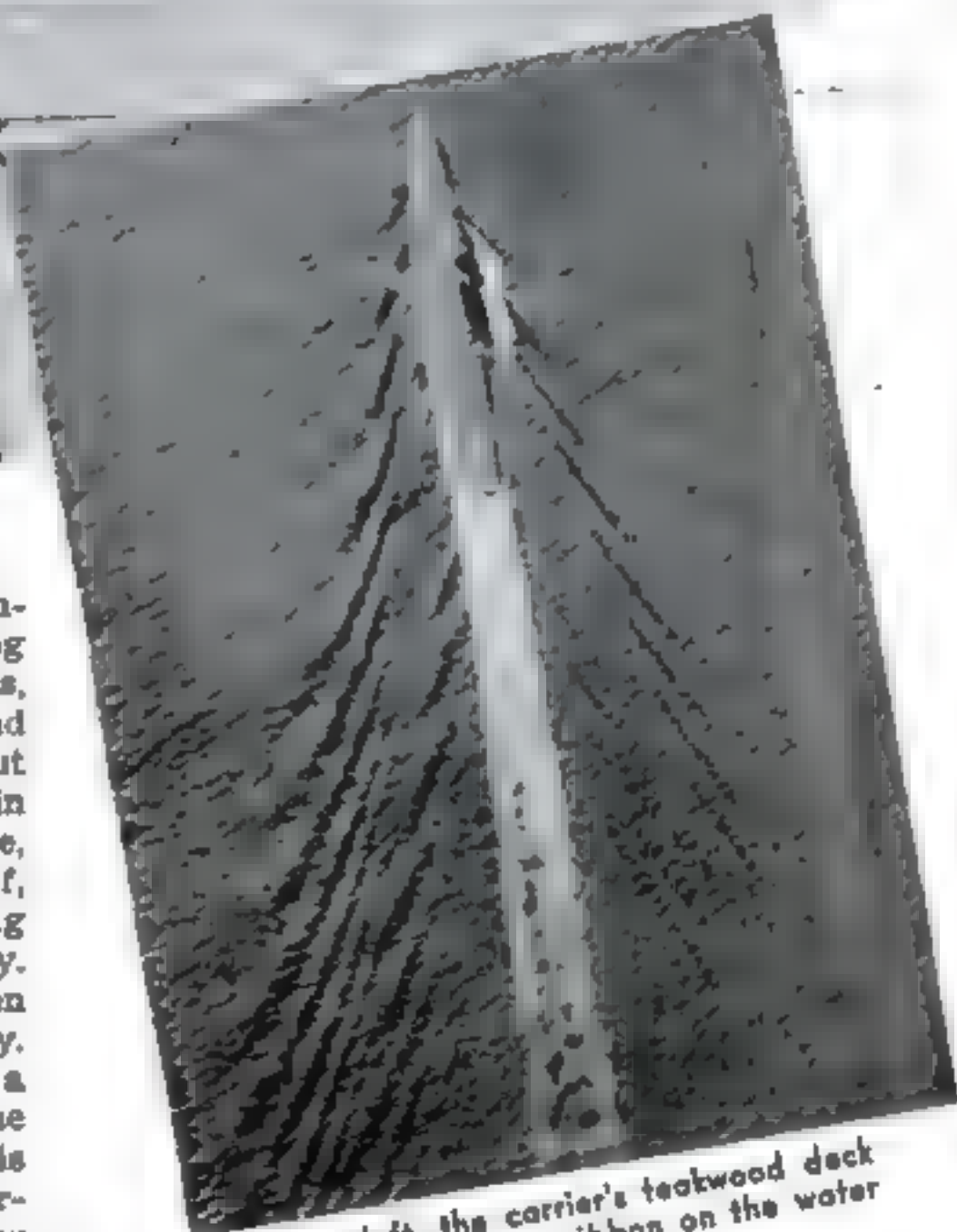
in fresh air and straightened out. In an instant, the white clouds of chemical fog closed in again. For more than four minutes, I kept skidding violently first to one side and then to the other; bursting momentarily out into fresh air and then disappearing again in the billows of white vapor. Behind me, stretching for more than a mile and a half, the trail of fog zigzagged like a writhing snake. Observers thought I had gone crazy. But those momentary emergences into open air kept me alive until the tank was empty.

That wouldn't happen again once in a million times. Every safety aid is given the carrier pilot. Equipment on such vessels is the best in the world. And, when an emergency such as I have described does occur aloft, a board of experts, later on, goes over every detail of the experience to plan additional safeguards for the future.

During twenty-three years in the Navy, including experience on many types of combatant ships and Yangtze River gunboats, I have had about all the fun and adventure the service has to offer. But the biggest kick of all has been flying with the "carriers"—three of the largest in the world, the pioneer *Langley*, the *Saratoga*, and the *Lexington*.

Even when the unexpected doesn't add to the excitement, a flight from one of these sea airports is thrilling enough in itself.

With brakes on and motor roaring, your ship stands poised between twin yellow lines running the length of the deck. You get the signal, release your brakes, race down the 800 feet of teakwood that forms the runway, and lift into the air. A moment later, another plane follows you. Thus, in rapid suc-



From far aloft, the carrier's teakwood deck looks like a tiny brown ribbon on the water

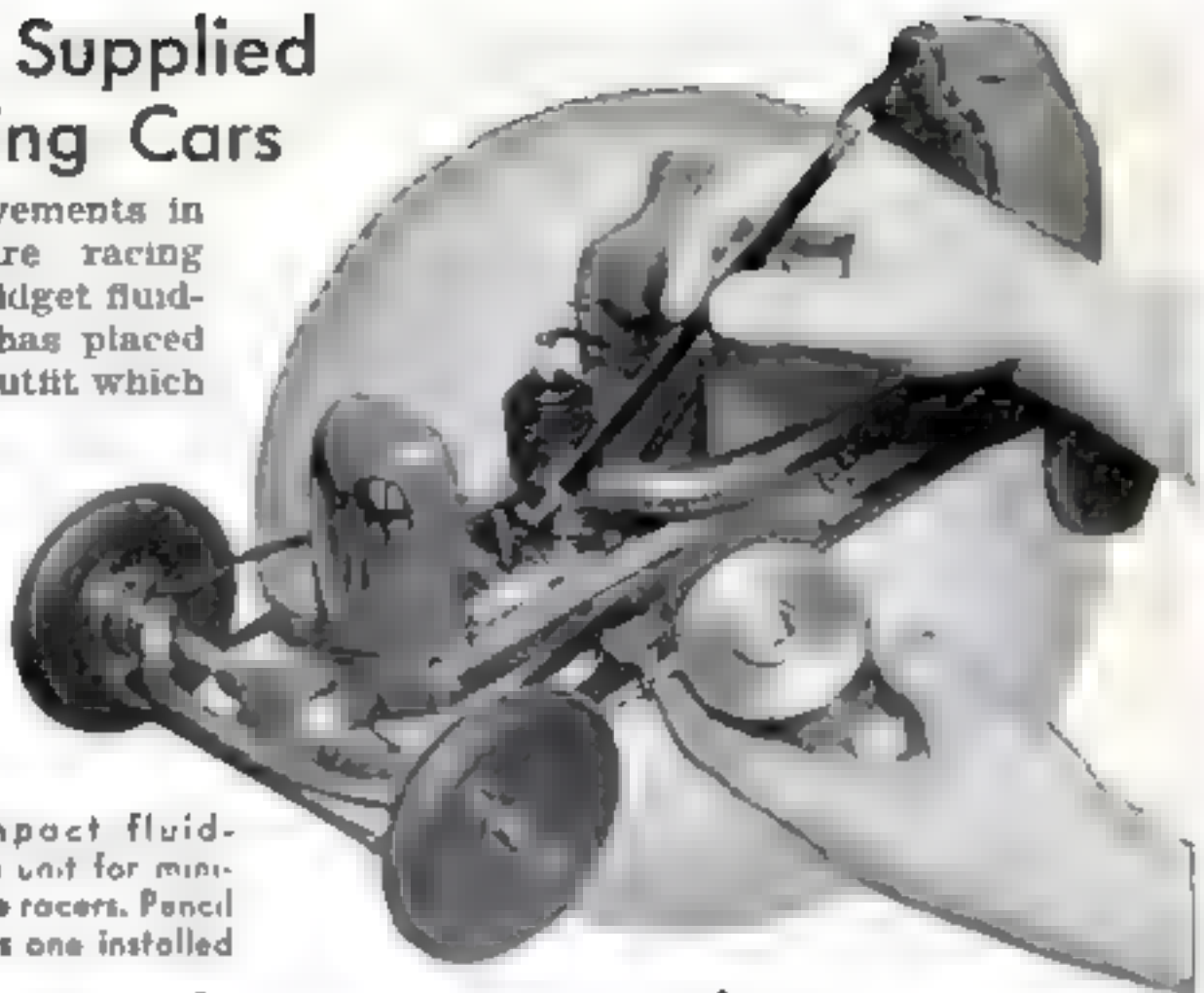
cession, the sea hawks take wing. Between seventy and ninety planes ride on one of Uncle Sam's large carriers. The smallest are single-seat, high-speed scouting planes; the largest, Douglas bombers.

Every flight from an aircraft carrier is made for some specific purpose. Like signal practice in football, life aboard such a ship is a succession of drills, a perpetual effort to increase efficiency. Four times a year, sham battles, or Navy games, are carried out at sea with carrier pilots discovering and attacking the "enemy." The weeks between are spent in radio drills, navigation study, dive bombing, gunnery practice, homing drills, and group exercises. Over and over again, operations are repeated until they fit like cogs into a smooth-working machine for offense and defense. *(Continued on page 216)*

Fluid-Drive Unit Supplied for Model Racing Cars

FOLLOWING the latest improvements in full-size automobiles, miniature racing cars have been equipped with midget fluid-drive units. A manufacturer has placed on the market a compact little outfit which slips into the place usually occupied by the flywheel. It is connected to the crankshaft and the driving mechanism by a keyed shaft similar to that used for maintaining the flywheel in position. It is believed that by reducing friction, such units will aid the Lilliputian racers to attain higher speeds than have been reached with the conventional drive.

Compact fluid-drive unit for miniature racers. Pencil shows one installed



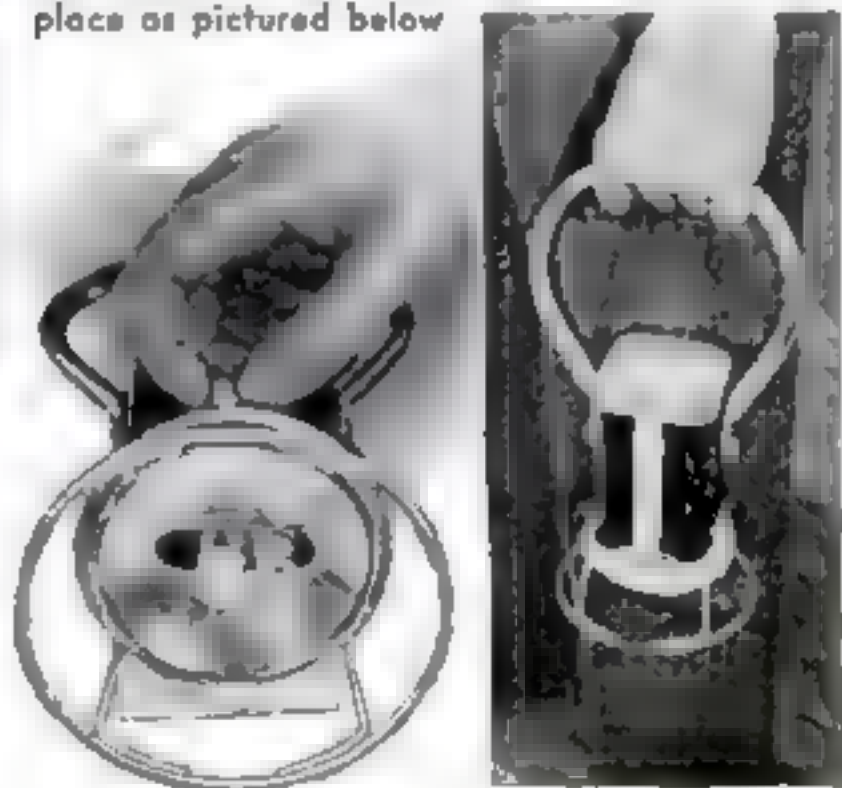
New Machine Produces Record Pressures



Dr. Roy Goranson with his new high-pressure machine

Upon an area no larger than the picture at the left, a pressure of more than 28,000,000 pounds could be exerted by a new apparatus recently demonstrated at the Carnegie Institution geophysical laboratory, at Washington, D. C. Its pressure of 3,000,000 pounds to the square inch is the greatest ever attained by any machine that man has produced. Dr. Roy Goranson, of the Carnegie Institution staff, is the inventor of the superpressure apparatus. He will use it to replace less powerful apparatus in researches concerning physical and chemical changes which occur in substances when they are subjected to tremendous pressures.

When one bulb burns out, the other is slid into place as pictured below

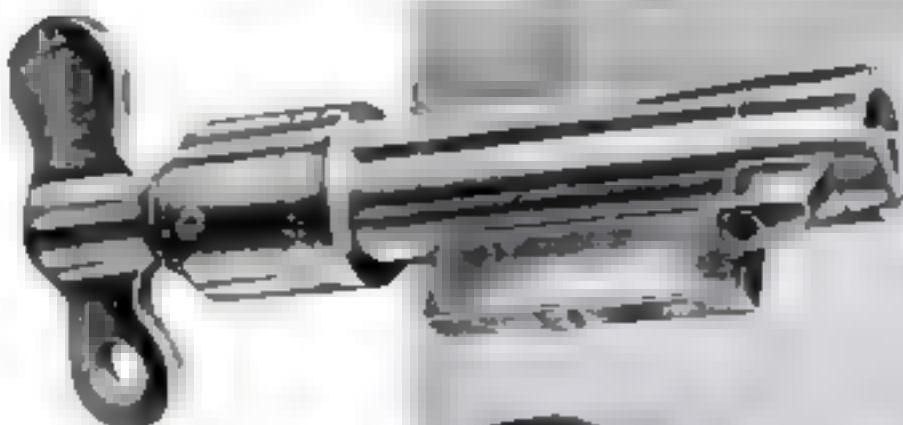


Lantern Has Spare Bulb

Two bulbs on a sliding carriage form the novel feature of a new electric lantern. If one bulb burns out, the other can be snapped immediately into position simply by moving a small lever on the side of the lantern.

New Signal System Checks on Watchman

TO PROVIDE positive assurance that night watchmen make all the rounds assigned to them, a novel signal-box system has been developed. In a factory or warehouse, numbered signal-box stations are placed at various points, the last box being electrically connected with the policing headquarters. The watchman is provided with a special key fitted with tumblers like a cylinder lock. At the start of his rounds, the key will only fit into signal box number one. Turning the key in this box shifts the tumbler combination so that the key will now fit only into signal box number two. This process continues until he reaches the last box, where a turn of his key resets the tumblers for the next round.



The new tumbler key. Inserting it in one signal box shifts tumblers to fit next

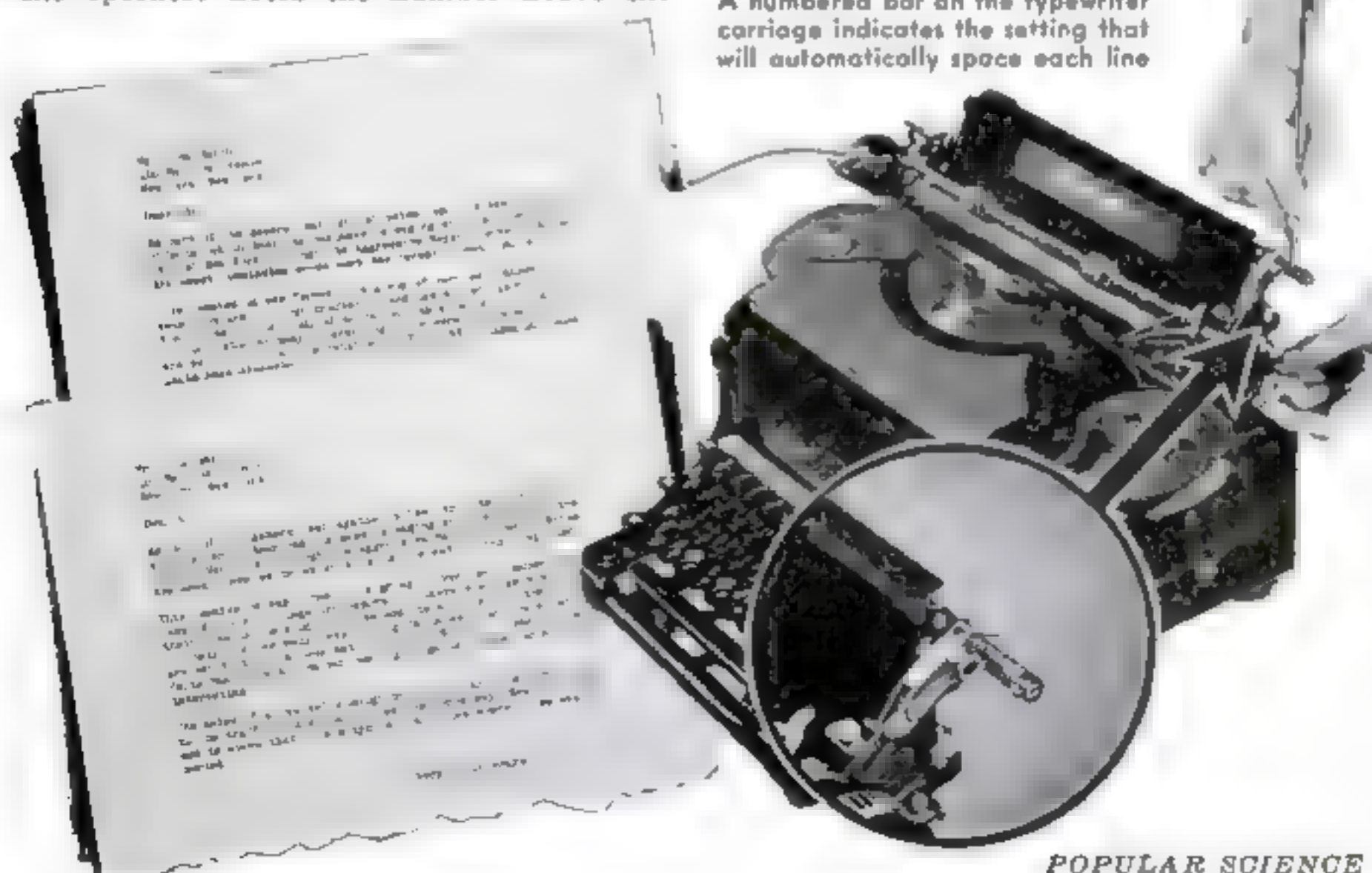


Typewriter Spaces Words To Fill Lines

DESIGNED especially for use where correspondence or other typed material is to be reproduced, a new typewriter has an attachment which assures neat, perfectly aligned right-hand margins. The typewriter carriage is provided with a numbered metal bar and a sliding pointer. At the end of each line, the operator notes the number above the

pointer. In retyping, at the beginning of each line a knob is set to correspond with the number marked for that line on the original. The attachment then automatically word-spaces the copy to make all lines of the same length.

A numbered bar on the typewriter carriage indicates the setting that will automatically space each line





Serving ready-made sundaes. Sauce is inside the ice cream

Ice Cream Contains Sauce for Fudge Sundae

FUDGE sundaes, with the sauce inside instead of outside the ice cream, are a confection novelty recently introduced by a new York City concern. During the process of manufacture, the sauce is injected into the ice cream so it is evenly distributed throughout. The new ice cream comes either in bulk or brick form.

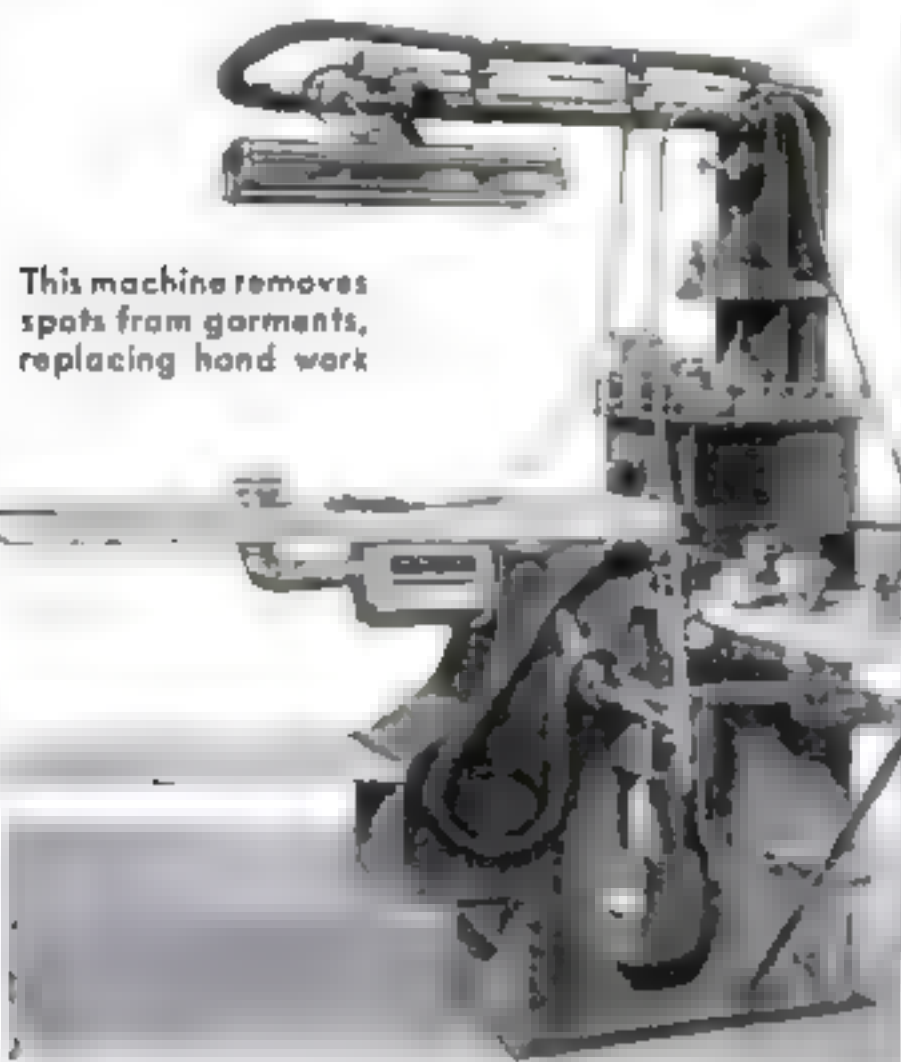
Liquid Wood Promises New Synthetic Fibers

LIQUID wood, made by processing wood to add hydrogen to the molecules, has been produced in Canada. The water-white liquid is expected to provide the raw material for many new synthetic products, including fibers resembling silk.

Spot Remover Speeds Dry-Cleaning Work

THREE years of experimenting in his dry-cleaning establishment has enabled Carl Dahlberg, of Duluth, Minn., to invent a machine which replaces hand work in removing spots from clothing. The new apparatus, the inventor believes, will do better work, save time, and increase the number of jobs a dry-cleaning shop can finish in a day. Live steam, in addition to stain-

removing chemicals, is applied to the fabric in the Dahlberg spot remover. By means of a vacuum, the apparatus dries the fabric rapidly after the blemish has been eliminated. It is said to remove every trace of the chemicals used in the work.



This machine removes spots from garments, replacing hand work



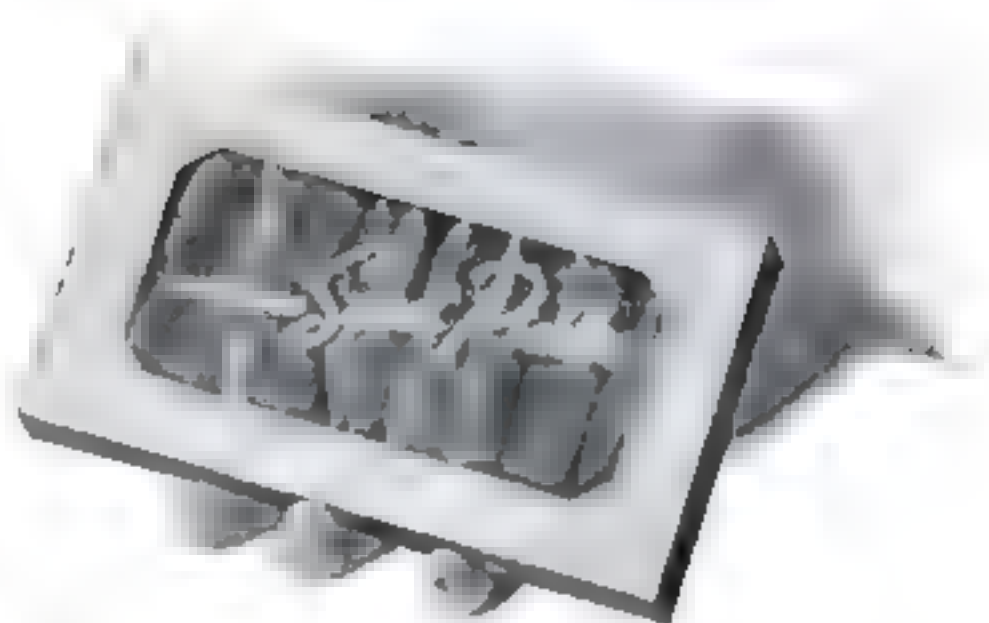
Carl Dahlberg the inventor demonstrates how live steam is applied to a fabric to help eradicate blemishes

Soles for Ladder Workers Give Safety Grip

WORKING on ladders is made easier and safer, it is reported, by simple nonskid, rung-gripping soles which can be strapped to any shoes. Made of steel covered with rubber, the new "ladder shoes" have, beneath the instep, a special groove which fits over the rung and prevents slipping. They are said to reduce fatigue for workers who use ladders constantly.



Groove under instep grips rungs of ladder. Right, close-up of sole



Pickles Put in Packages of Transparent Rubber

PICKLES, packaged in envelopes of a transparent rubber product, have been introduced by a leading American food packer. The water-tight container, which is protected by a cardboard box, holds neatly arranged sweet pickles which are packed in fluid just as when they are sold in glass bottles. Besides increasing the attractiveness of the commodity, the new method of packing is reported to eliminate bottle breakage and to reduce the weight of the containers.

Helicopter Is Target in Shooting Game

WITH rubber bands for ammunition and a spinning toy helicopter for a target, a new parlor shooting game provides both excitement and training in marksmanship. The

pistol is capable of shooting six rubber bands in quick succession. The first is fired at the bullseye of a target. A hit trips a mechanism which sends the helicopter spinning in-

to the air as a flying target for the remaining shots in the rubber-band six-shooter. The gun is loaded as shown below.



Right, loading the pistol. Also, the bullseye that releases the flying target



New Form of Trap Shooting Reduces Cost

BECAUSE many of America's 7,000,000 hunting and shooting fans do not have access to regulation skeet or trap-shooting ranges, or cannot afford the sport, a new type of clay-target shooting has been developed which is far less expensive and requires a much smaller space than the regulation sport. The new game utilizes specially designed guns firing .22 caliber, shot-packed long-rifle cartridges, light inexpensive targets, and a portable trap to throw them.



Shooting costs are greatly reduced with the outfit shown here in use

Miniature Bowling Is Table-Top Sport

BOWLING on a miniature alley using tiny pins and balls is a novel sport that has gained great popularity in California. Although the equipment can be purchased ready-made, many enthusiasts prefer to make their own sets. The pins weigh seven eighths of an ounce, and the balls one and five eighths ounces. The alleys themselves, which are set on adjustable legs to make them level on any terrain, measure seven feet, four inches from the end to the head pin, and eight feet to the padded pit used to catch the pins knocked over. The width of the alley is eight

and a half inches, not including the gutters and side troughs down which balls are returned from the pit to the bowler.



Everything is to scale in the tiny bowling alley that may be set up in your back yard or cellar game room

GADGETS FOR

ROD HOLDER
Lazy sportsmen will like this device, which screws into any handy piece of wood. A wire cable covered with rubber grips the handle of the rod. Another type is anchored by a clamp.



FLY BOX. Flies are visible at all times in this novel box. To remove one, the transparent top is turned until the small door is over the proper compartment.

LURE EAT LURE. Here is something new in lures: a dummy fish represented as swallowing another one.



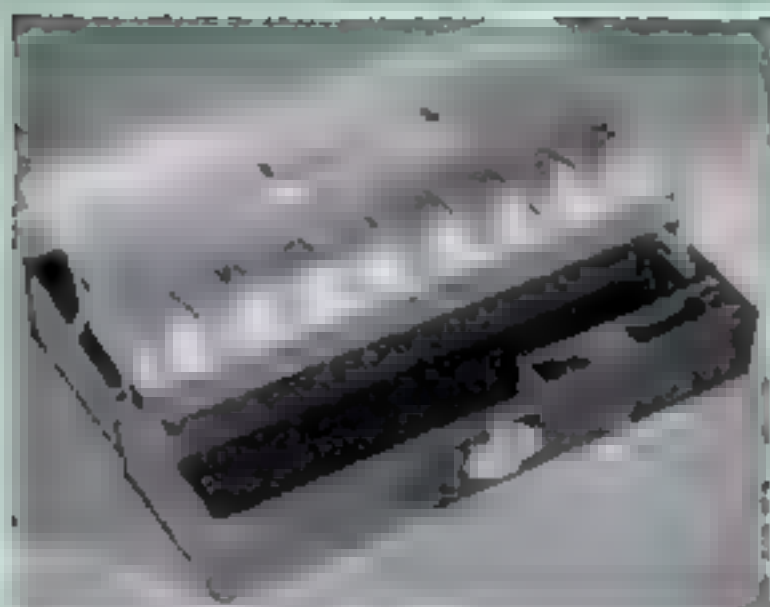
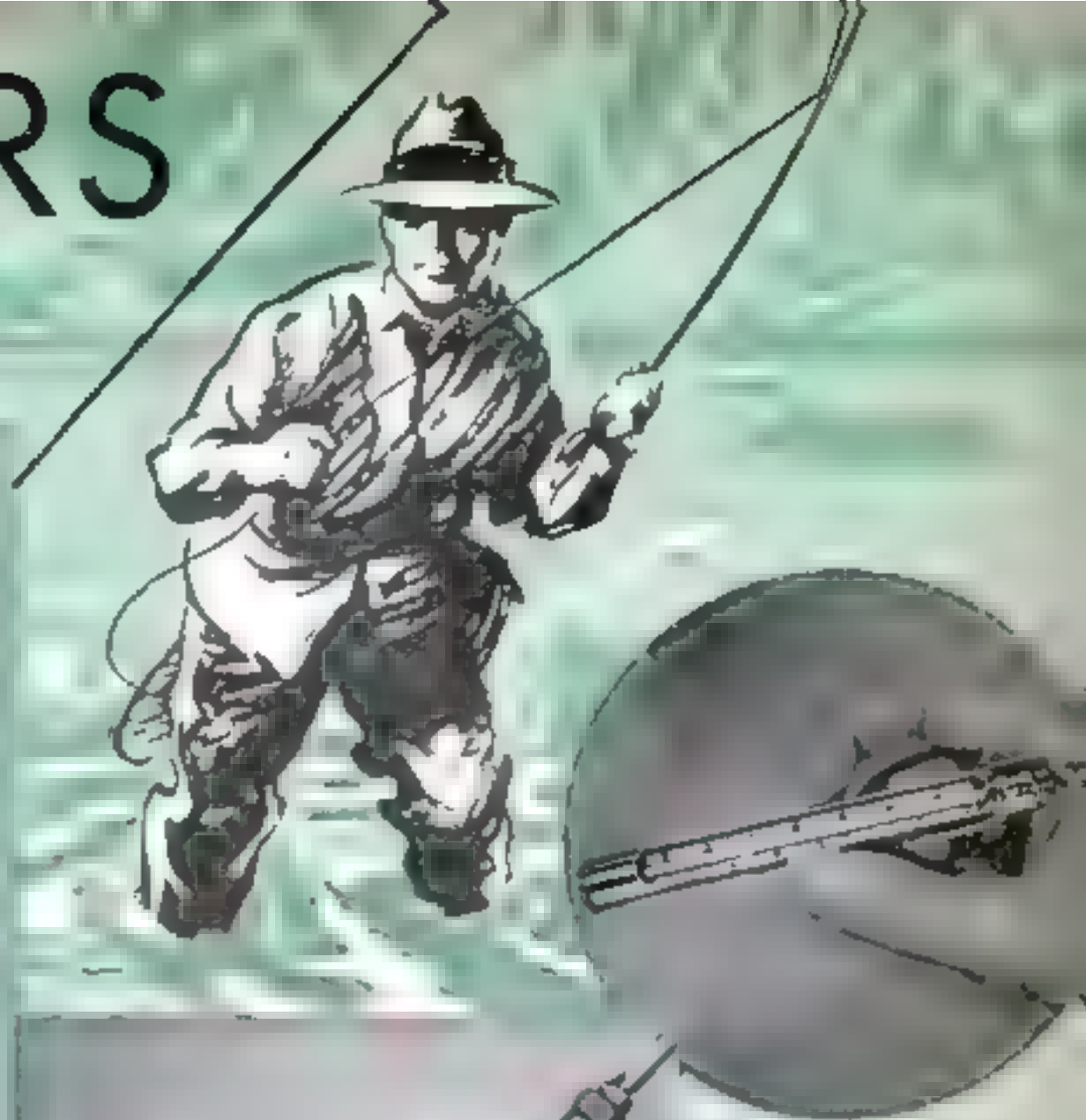
LEVER-ACTION VISE. Made for anglers who tie their own flies, the fly vise shown below grips the hook with a single easy action of a lever.



ALUMINUM CREEL
Both fish and tackle can be carried in the lightweight metal creel above. One side will hold about eight pounds of fish, and the other takes the gear.
TROLLING FIN. Acting as a rudder, the fin at the right keeps the line from getting twisted in trolling with live bait.



ANGLERS



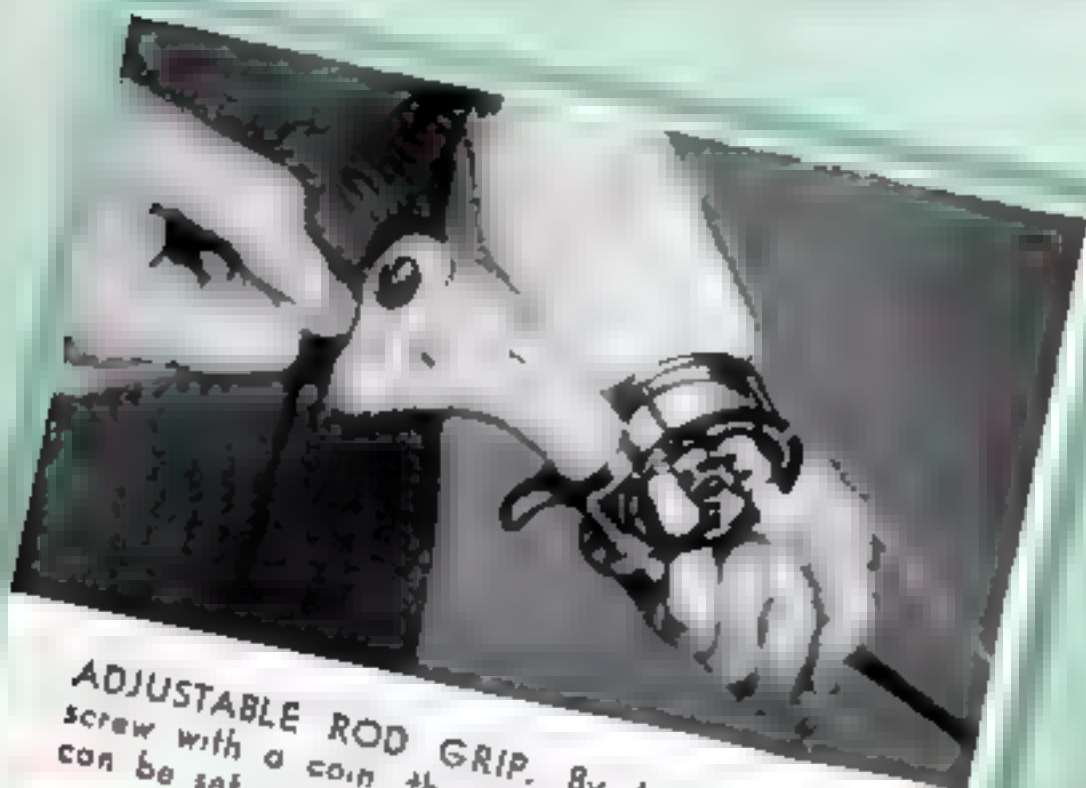
HANDLE LOCKS BOX

No danger of this tackle box coming open and spilling its contents. When its handle is in the carrying position shown, the lid is automatically locked.



ROLLERS ON REEL

Two tiny metal rollers, on a reel of novel design, are said to keep the line from snarling and to dry it as it is reeled in. The reel is built right into the rod.



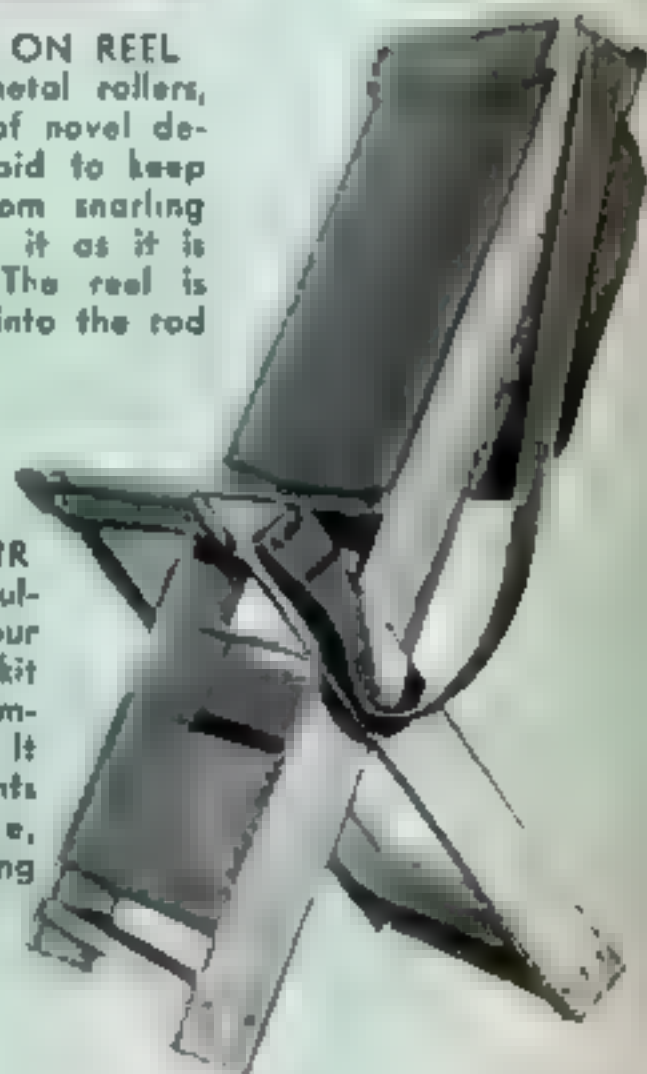
ADJUSTABLE ROD GRIP. By turning a set screw with a coin the pistol grip of this rod can be set in the position that suits the hand.

FISHERMAN'S THERMOMETER

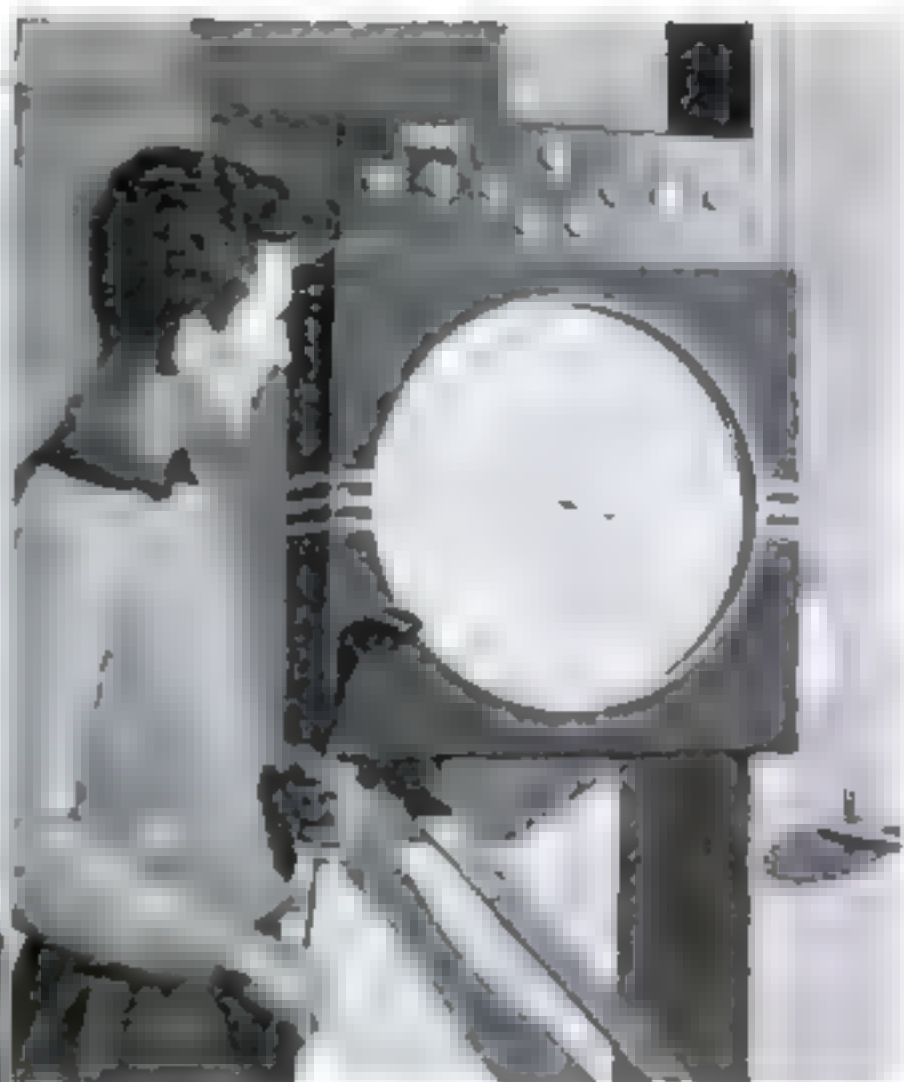
This handy instrument helps you to find the waters the fish like best. It has a ring for attaching to a line, and a pocket clip.

KIT-BAG CHAIR

Carried on a shoulder strap like your golf bag, this kit unfolds into a comfortable chair. It has compartments for bait, tackle, and spare clothing.



Electric Eyes Gauge Golf Practice Drive



Dial registers distance of drive, and lights above it indicate any hook or slice. At the left, a player is teeing off on the coin-operated device

C OIN-CONTROLLED, an ingenious golf practice machine automatically registers the length of a practice drive, and the amount of hook to the left or slice to the right. As a player drives the ball from the tee against a backstop, an electric-eye mech-

anism gauges the speed of the ball and indicates the theoretical yardage on a meter. The rubber tee is mounted on a ball-bearing turntable so that it spins if struck incorrectly by the club head, spinning in one direction when the ball is hooked and in the other when sliced. The amount of hook or slice is shown by numbered lights above the yardage dial.



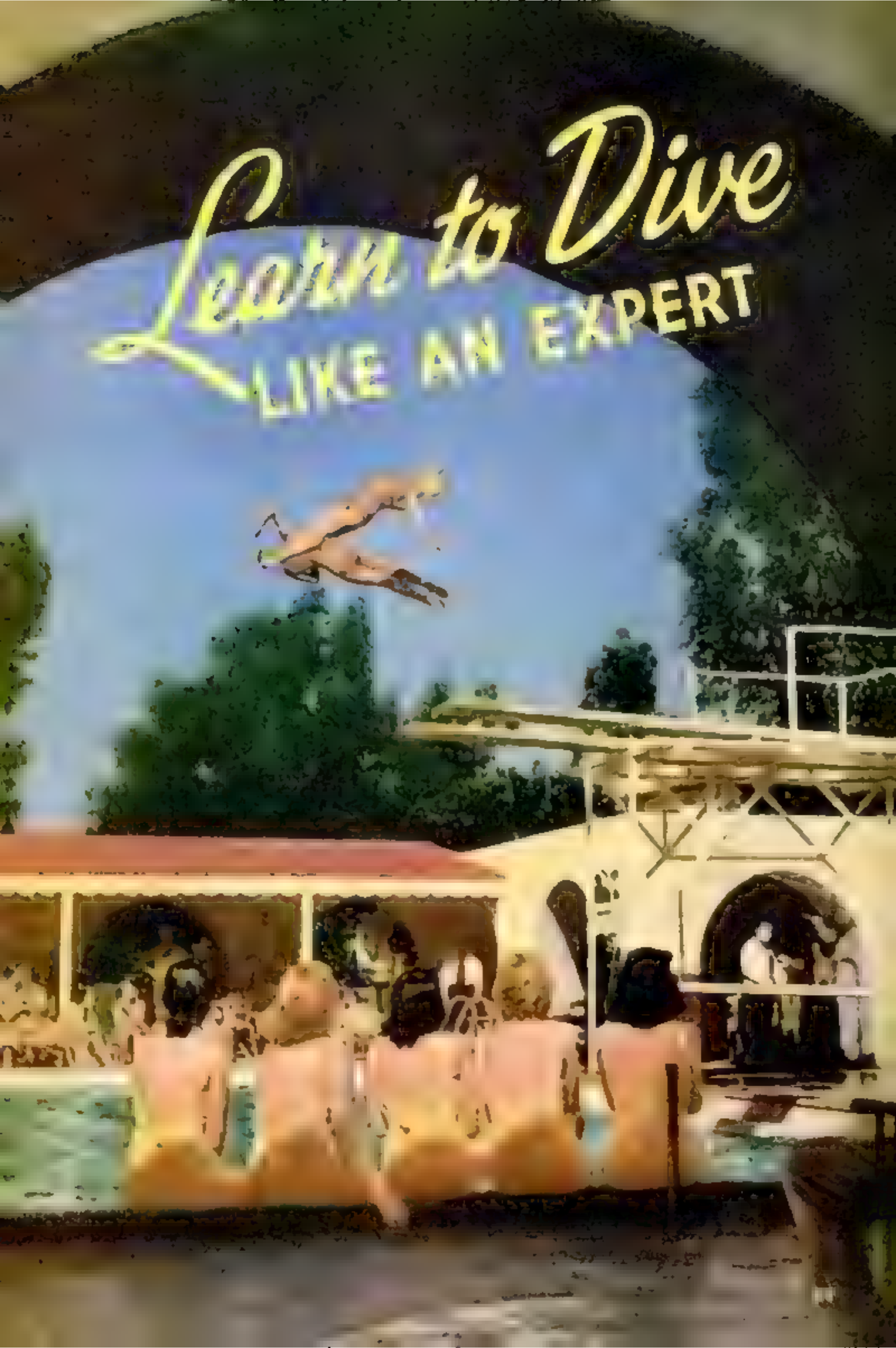
Inflated Owl Decoys Crows

CROW hunters have been supplied with an unusual accessory in the form of an eighteen-inch pneumatic decoy owl, which can be carried rolled up in a coat pocket and inflated when needed. Crows are hereditary enemies of owls, and attack them whenever they find them in daylight. Hence, the decoy

placed on an upright stick in an open space attracts the crows and brings them within gunshot. The body of the decoy owl is made of heavy, durable canvas which is painted realistically.

Easily carried in a coat pocket, this canvas owl is inflated and set up to attract crows and bring them in range of hunters' guns







A fun dive containing two different movements is a spectacular stunt.



Like a flying arrow, a diver hits the bullseye of a target in the pictures of Jeff and Kew. Tricks like this require coordination and control.

SIMPLE RULES, OUTLINED BY A CHAMPION, WILL HELP YOU TO BE A BETTER DIVER

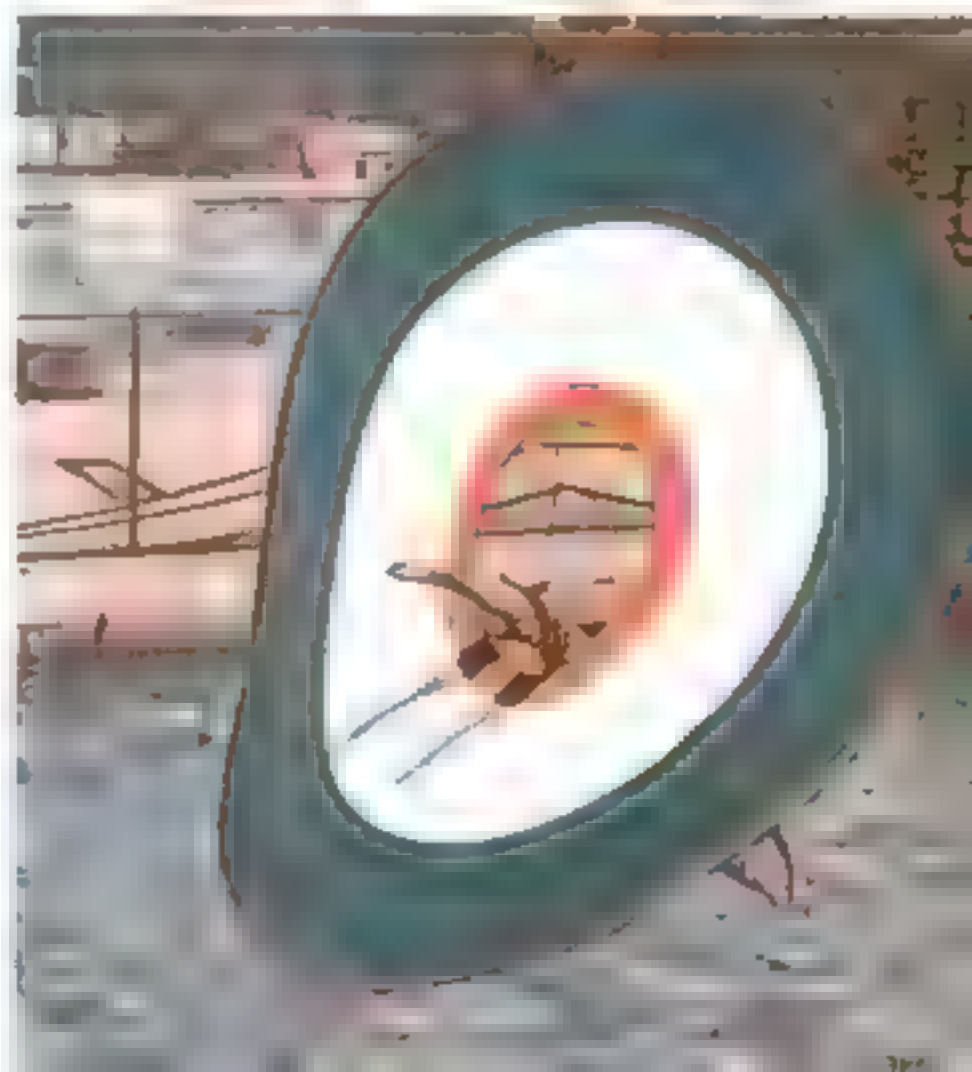
GLIDING along the springboard in easy strides, you bounce down onto the tip and feel the springy plank catapult you skyward. High over the water, your body under perfect control, you suddenly whirl in mid-air and knife down into the blue water below. Knowing you've made a perfect dive, you bob to the surface, your ears ringing to the applause of the crowd. That's the thrill of diving.

But if your experience is limited to occasional bellyflops from the rim of a pool or swimming hole, you probably feel that springboard diving is a difficult sport to learn. Well, it is—and it isn't. I've been at the game for sixteen years, and I know I still have plenty to learn. But picking up the fundamentals of basic dives such as the swan or the graceful back dive, is far from an impossible task even for

By ALF PHILLIPS

FAMOUS OLYMPIC DIVER AND
STAR IN BILLY ROSE'S AQUACADE

Triple swan dive.
Silhouetted against
the sky, graceful
figures poised in
flight compose a
picture of beauty





Soaring like birds, seven swimmers take off into the air in swan dives. Known technically as a forward header, this graceful dive is not specially difficult to master.

The end of a perfect dive: In this remarkable underwater photograph, made through the glass walls of a tank, you see the cloud of bubbles that follows the diver.

The foremost figure at right
is in a half gainer pike posi-
tion the other in a jackknife

Below, a mermaid does
a forward header with
half twist, a varia-
tion of the swan dive





Frozen motion: a pose in the forward one-and-a-half, in pike position



Many dives can be performed in the tuck position demonstrated above. The body is drawn up in a ball, with hands grasping legs



a rank beginner. And master dives, the more complicated ones are only a matter of determination and practice.

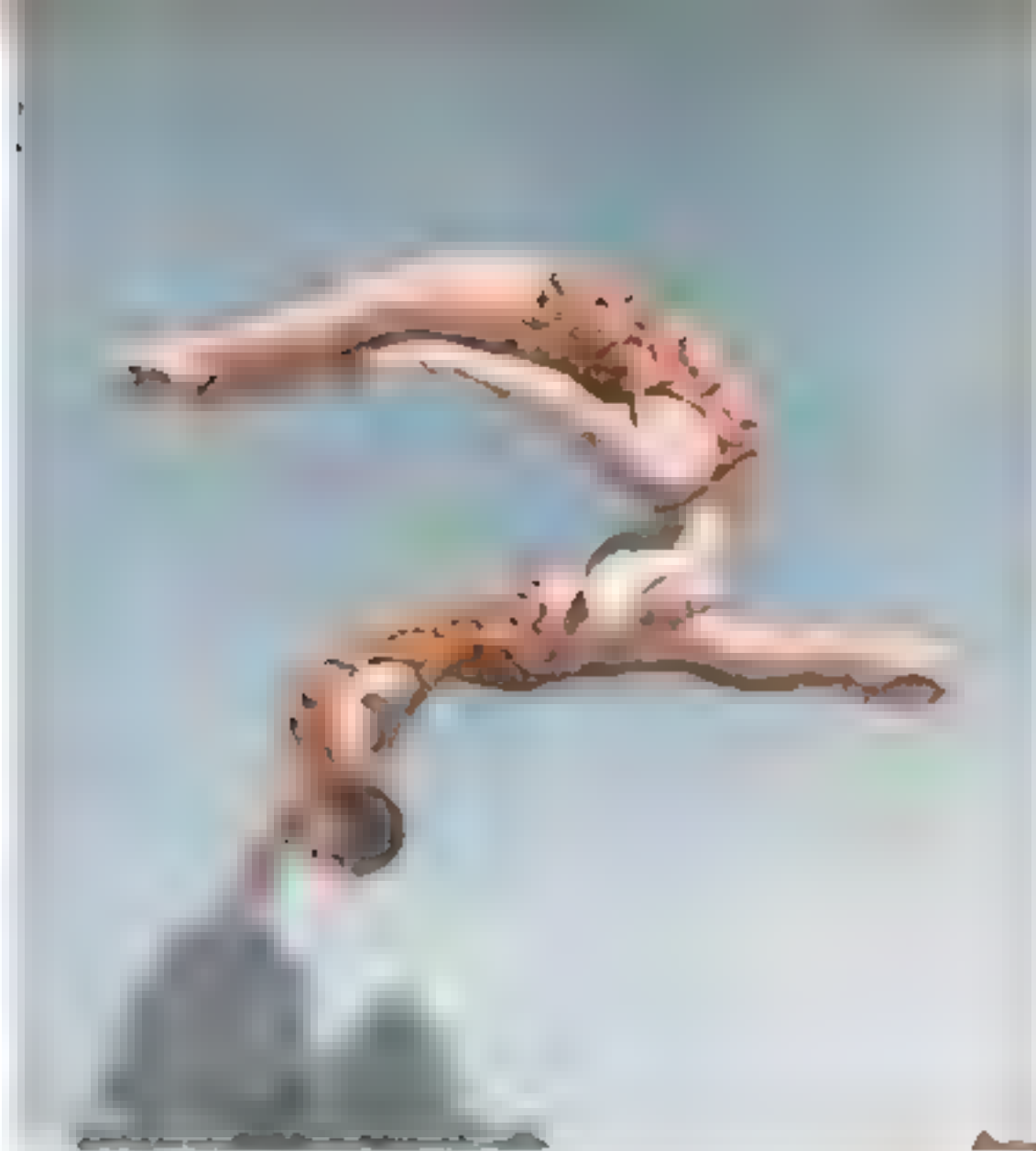
To start with, your body must be supple, for in diving, flexibility is more important than mere strength. I'd advise you not to go near a springboard until you've put yourself through a series of exercising workouts. Choose simple exercises that tend to stretch your arms and legs, loosen your spine, and toughen the muscles of your abdomen. A good diver should be able to bend from the hips and touch his head to his knees, while keeping his legs straight. When you can do that—and it's not as hard as it sounds—you are all set to step up here on the springboard.

But you're not yet ready for your first dive. For if I'm doing the coaching, you'll park there at the shore end of the board while I hammer home this point. Good divers think out every phase of each dive before they make a move: the run, or approach to the end of the board; the take-off from the tip; the flight through the air; and the entry into the water. It's good to make this a fixed habit.

Got that? O K, now walk out onto the end of the board and start bouncing up and down on it in continuous, rhythmic leaps, swinging your arms upward to add to your lift as you leave the board, and straightening your legs and pointing your toes while in mid-air. "Ride the board," that is, time your arm swing with the beat of the board, and strive for height. You may think this bounding up and down isn't getting you anywhere, but it is developing your sense of balance, teaching you to coordinate your movements, and giving you the "feel" of the board.

Now for some more pointers while you're resting up from your bouncing practice. Many dives can be performed in three different ways: straight, with no bend at either the hips or the knees; with a "pike," in which the legs are straight but the body is bent at the hips like a jackknife and the arms are extended either sideways at shoulder level or forward toward the toes; and lastly, with a "tuck," in which the body is drawn up





A half gainer (above) and a backward header or back dive. For more views of divers in action, see the following page



The pike position is better known as the jackknife. Body is bent at the hips, as illustrated above

into a tight ball, with the hands grasping the shins or ankles.

All right, you're ready for your first dives, which should be made feet first. Practice these three positions—straight, pike, and tuck—in mid-air after taking off from the board. Do them first from a standing take-off, and then from a running start. In the latter case, take at least three gliding steps along the board, and then a jump or hurdle step that will land you down on the tip. Hit the tip with the balls of your feet, and try to land in the water about three feet out from the end of the board.



When you've mastered these practice jumps—and they're easy enough—try a few other positions. The star position, for example, in which you first assume a straight vertical posture in mid-air, then spread your arms and legs wide apart, and return to the straight position before entering the

water. Now combine the straight jump with a half twist so that you face the board as your feet hit the water. Then go on to combine a pike, or jackknife, with a half twist. Sure, you'll fall flat on your back a few times, but keep at it—you're getting places now.

And while you're recuperating from that last bellyflop, let me tell you that in every diving meet from a one-meter board (a springboard approximately three feet up from the water), you'll be called on to execute five compulsory dives and then five other dives of your own choice. These compulsory dives are (1) the

running forward header, or swan dive (2) the backward header, (3) the running half-gainer; (4) the backward spring, forward dive, or back jackknife, and (5) the forward header with a half twist. To see what each of these looks like, glance at the sketches on these pages.

I'll give you a few hints on how to do the first two. When you've got them down pat, you can progress to the more complicated dives on your own, for by that time I'll guarantee you'll be a diving (Continued on page 223)





In the forward header with full twist, left, the body turns completely in a r

Shadowy figures float across the sky in a swan dive. When you can match this grace and ease, call yourself a diver!

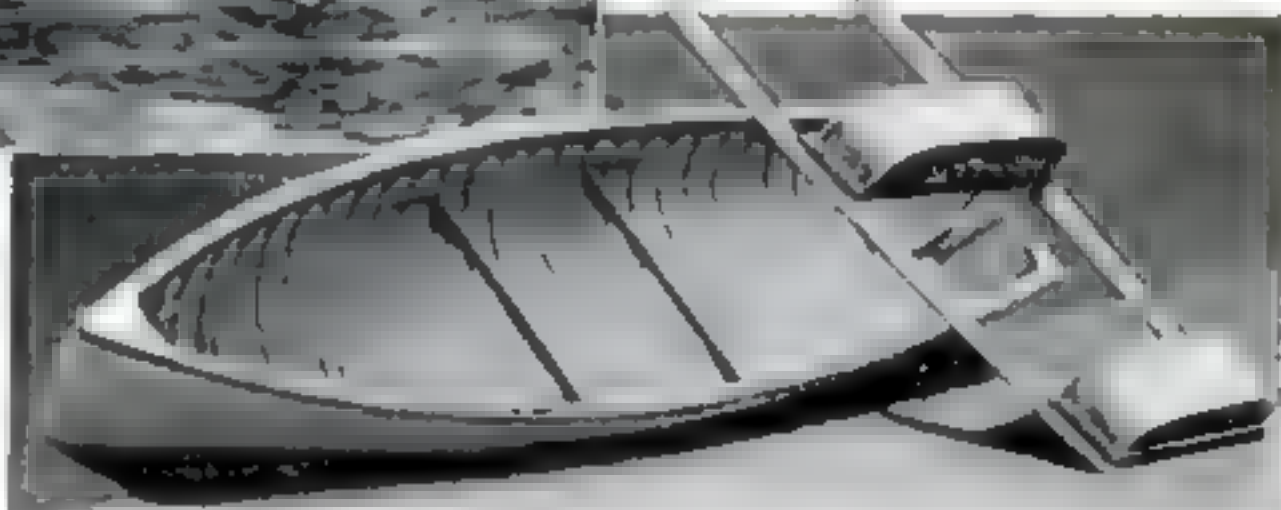


Life-Saving Raft Fits in Boat or Canoe

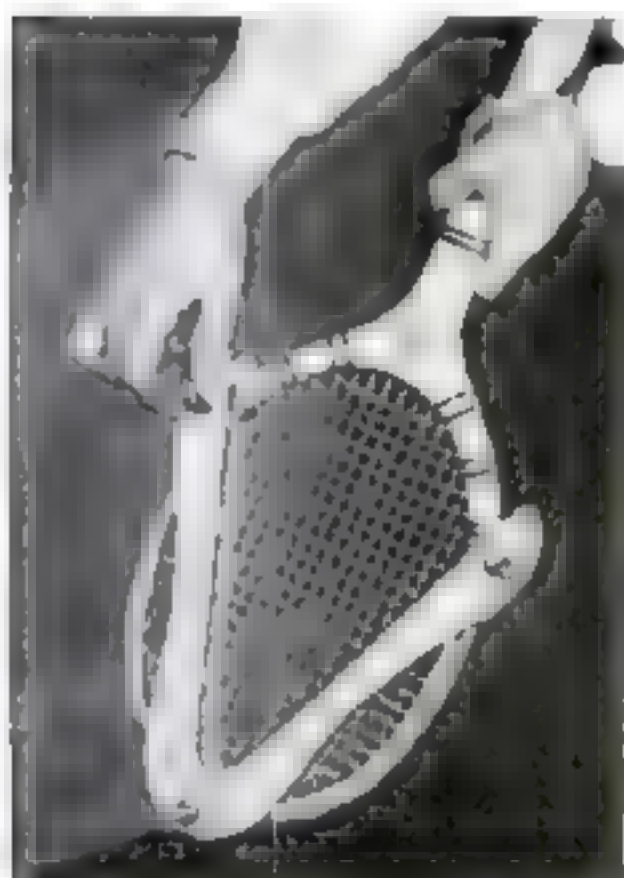


Testing the new safety raft. Below, a boat and its removable frame for seats and air chambers

AIR CHAMBERS built beneath seats in a framework that can be adapted to fit any type of canoe or small boat, form a novel life-saving raft. When a boat equipped with the raft capsizes, the air chambers buoy up the craft, making it float high in the water, so that passengers can either climb up on the bottom or right it easily. The air-chamber raft is not fastened to the boat but merely set in place on the bottom, so that



it will float free in case the boat fills with water. It can then be paddled ashore, whereas a boat with fixed air chambers would be water-logged. A four-chambered raft is said to support fourteen persons.



Racket press in place. When not in use, it takes up little space

Racket Press Folds Compactly

V-SHAPED, a new lightweight press for tennis rackets is hinged so that it can be folded compactly when not in use. It is applied by tightening bolts that clamp over the shoulders and end of the racket.

Chart of Outboard-Motor Dope

SELECTING the right type of outboard motor for a boat, and vice versa, is simplified by a handy sliding information card now available. Horsepower, weight, miles to the gallon of fuel, and maximum speed with any combination of boat and motor, can be quickly determined by adjusting the sliding card as illustrated below.



A sliding card helps to choose the right combination in a boat and motor

Portraits In Stained Glass Are New Art



Created in stained glass from details of the photograph at right, this portrait is made with the same materials and methods as those used in famous church windows



YOU can now have your portrait done in stained glass. This is the novelty made possible through the work of two Dutch artisans, J. Schrier and Huib du Ru, who have adapted to human portraiture the age-

old technique of fashioning the stained-glass windows that adorn churches and cathedrals all over the world. The glass portraits can be made in practically any size, either small

enough to form one pane of a window, or large enough to serve as an entire window in itself. The first step in the glass-portrait process is to make a sketch of the subject, either from life or from a photograph or other good likeness. Transferred to glass, the portrait is then colored and cut up into the various sections that will later be reassembled and joined together by small strips of lead. White transparent glass is used, the coloring being applied to both the front and the back surfaces to enrich the final effect when light streams through the window portraits. A photograph of a subject, together with the glass portrait made from the original by the new method, are reproduced at the top of the page.



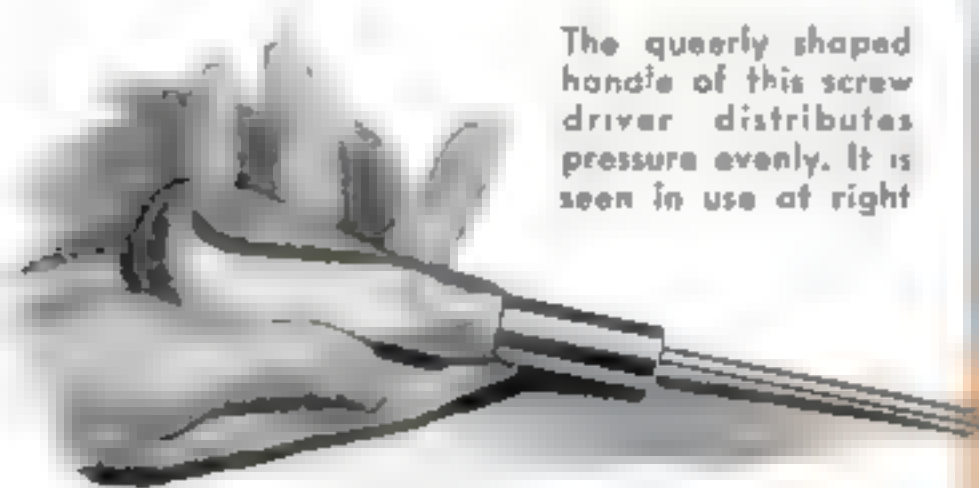
At the workbench where the artists cut, stain, and lead the glass



Angelo Bisenz making a clay model of one of his novel designs to be cast in metal

Designer Shapes Pens, Tools, and Glasses That Fit the Hands

DESIGNING fountain pens, screw drivers, razors, and other common articles so that they are not only pleasing in appearance but also better adapted to their specific uses, is the job of Angelo Bisenz, New York City designer who calls his work "formogenic designing." A screw driver Bisenz designed, for example, has a handle formed to fit the contour of the hand, so that the tool handle will present its widest surface at the point where the hand will apply pressure on it. The same attempt to fit the instrument to the hand of the user is seen in his designs for a fountain pen and a drinking glass, illustrated on this page. In the latter case, the tumbler is provided with indentations that allow the fingers to grip it easily, while one side is rounded to fit neatly into the palm.



The queerly shaped handle of this screw driver distributes pressure evenly. It is seen in use at right

This is a "formogenic" drinking glass. Fitting the form of the palm, it is easy to hold



A fountain pen. In use, it nestles in the hand as shown in the upper picture



Pyramid Apartment House

EVERY tenant has an outside apartment in a pyramid-shaped house designed by Edwin A. Koch, New York architect. Some time ago, Koch planned a bank of apartments for a steeply sloping hillside. Then the bold idea occurred to him of joining four of the dwellings, back to back in a pattern like a cross, with the result shown above. Carrying modern set-back architecture to its logical extreme, the huge building provides a private terrace, with penthouse airiness, for every tenant above the fourth floor. No windows face the interior, a nat-

urally ventilated hollow core fourteen stories high. Its base of sixty-four-foot diameter provides ample space for cars to discharge and pick up passengers at passageways leading to the elevators. Pedestrians use exterior doors. Apartments are supplied from a central plant with washed, humidified, and heated air in winter and with unheated air for summer coolness. Open corners of the building's cross-shaped base provide a two-way automobile drive, a parking space for visitors, and two covered garages for tenants.

Blacksmith-Sculptor Forges Art

A BLACKSMITH'S shop serves as a studio and scrap iron and steel as raw materials, for David Smith, Brooklyn, N. Y., sculptor. From his forge and anvil come art objects of museum quality. After he has sketched a design and marked it for later coloring, an oxyacetylene torch cuts away the out-

line. Pieces for indoor display may be finished with lacquer, paint, or baked enamel. Smith has developed a fireproof cherry-red color, which he mixes with hard wax and melts upon the cooling metal. Sometimes he leaves the original surface irregularities and rust to enhance the artistic effect.

These pictures show David Smith at work in the smithy-studio where he beats out statues with hammer and anvil. Coloring adds to the beauty of figures like that at lower right.





Building the Golden Gate Bridge in miniature from parts of the kit

Realistic Model of Huge Bridge Available in Kit

A REALISTIC model of the San Francisco Golden Gate Bridge is now available in kit form for model builders and miniature-railroad fans. The model includes nine molded sections built to scale and following correct engineering principles. When completed, the diminutive bridge can be used as a decorative piece or can be employed in the layout of an HO-gauge model railroad. The steel cable system of the miniature span can also be of practical use as a radio antenna. In the picture at the left, the model is seen in course of construction.

Complete Cleaning Outfit Keeps Hats Spotless

FELT HATS may be thoroughly cleaned in sixty seconds at a total cost of about one cent each, according to the makers of a home hat-cleaning outfit just introduced. The cleaning set consists of a nickel-plated hat block, a rubbing pad, and a supply of cleaning fluid that will remove grease, smudges, perspiration stains, and other spots.



With this outfit you can clean a hat in one minute

Plywood Horse and Rider Aid Instructor

MADE of plywood, an animated model horse is being used in a New York City riding school to teach good form and handling to horseback riders. The legs, neck, and head of the plywood horse are movable, being hinged together on the animal's body, on which is mounted a model rider with legs and arms that can be also moved from one position to another. Enabling the riding instructor to demonstrate good and bad riding to his students, the model reduces the number of spills experienced by beginners at the sport.



A riding master explains jumping form with the aid of a plywood dummy

LET'S BE PALS! Odd Friendships End Old Feuds



Two tame mice obviously value the guardianship of this friendly Spitz



How a pet parrot and a St. Bernard hold their regular daily conference. Below, Pussy beams with pride over her adopted bloodhound puppy

A DOG that adopted twin mice, a cat that mothers a bloodhound, and a parrot that is chummy with a St. Bernard—these are the strange animal relationships pictured on this page. The Spitz, belonging to an Atlanta, Ga., resident, recently discovered two newly born mice in a closet, and instead of tearing them to bits, hauled them out and took on the role of their protector. The cat shown at the right decided to add a bloodhound puppy that her Forth Worth, Tex., owner brought home to her litter of ten-day-old kittens. The friendship between the St. Bernard and the parrot was formed in a Cleveland, Ohio, home.



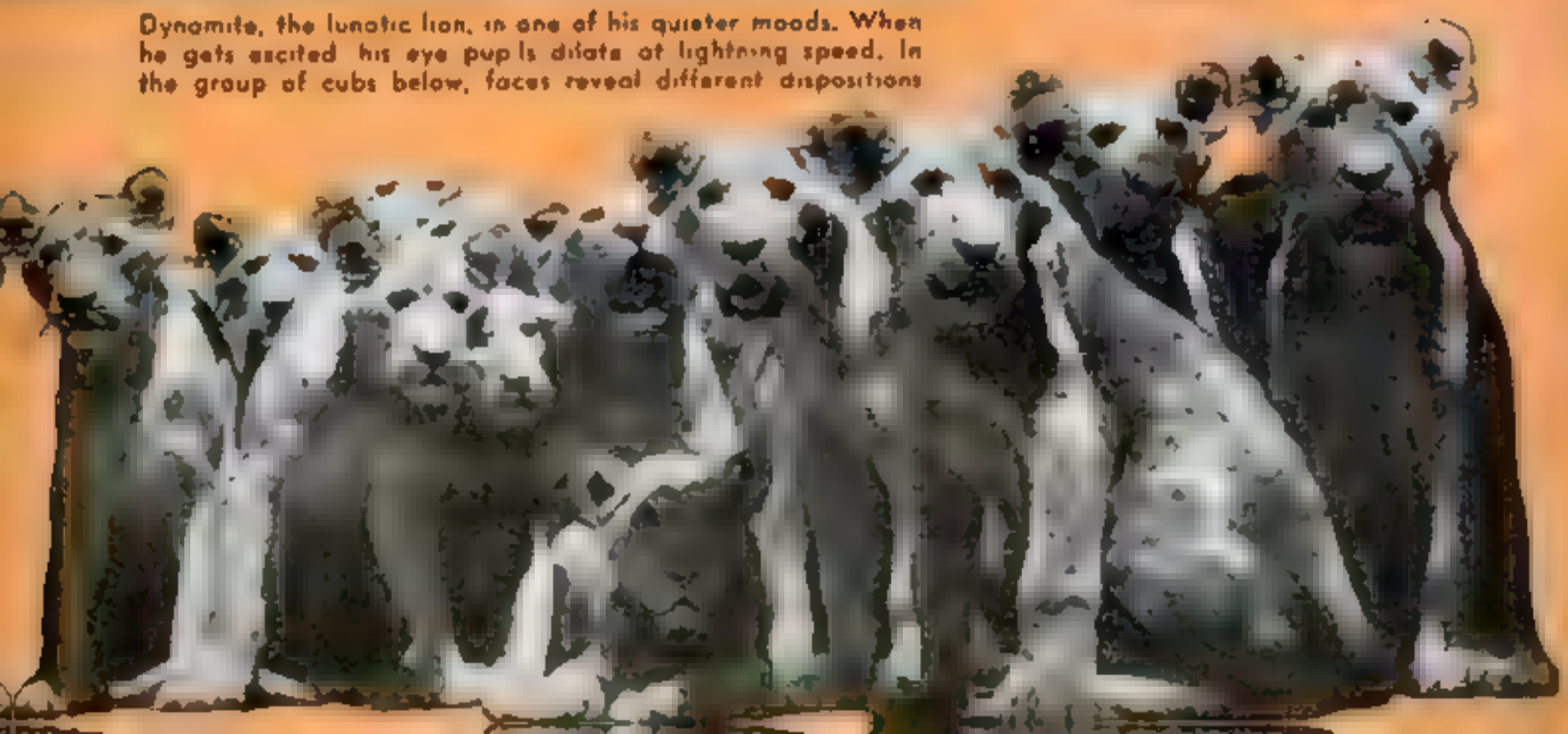
Taming

CAN a roaring, raging lion be permanently transformed into a tame and docile animal by an amazing new drug treatment? Working under the supervision of Dr. Knight Dunlap and Dr. Howard Gillhousen, psychologists of the University of California at Los Angeles, Joseph Cooper is preparing to try the fascinating experiment. One of his subjects will be the most vicious of 155 lions and cubs that roam a five-acre enclosure at Gay's Lion Farm, El Monte, Calif.

About two years ago, Cooper explains, a Hungarian anatomy professor discovered that some human mental disorders responded favorably to repeated injections of a drug called metrazol. After an initial shock to the nervous system, complete cures frequently resulted. Dr. C. C. Speidel, professor of anatomy at the University of Virginia, recently learned how such cures take place. Treating tad-

By **ROBERT E. MARTIN**

Dynamite, the lunatic lion, is one of his quieter moods. When he gets excited his eye pupils dilate at lightning speed. In the group of cubs below, faces reveal different dispositions



Lions with Drugs

poles under the microscope, he found that metrazol attacked certain nerve endings and junctions in the brain, so that they literally disappeared. New ones soon grew in their places, and the sick brain became well once more. It was like breaking a poor telephone connection, and substituting a good one.

Boldly carrying on the experiments with the most dangerous of subjects, Cooper has been trying out metrazol injections on African lions to determine the dosage needed to bring about mental changes. For safety, the animal subject is placed in a "squeeze cage" devised at the farm for veterinary treatment (P. S. M., June '39, p. 96). Secured in any desired position by four notched handles, one side of the cage moves inward to pin the animal against the opposite side, while Cooper deftly injects the chemical into its blood stream.

After these preliminary experiments, Cooper intends to try the metrazol "taming" treatment upon Dynamite, his prize patient. This hulking mass of concentrated meanness has killed five other male lions in gang fights. So much as point a finger at him, as he glowers at you from a cage, and the pupils of his eyes open with camera-



In the oval above, Joseph Cooper is giving one of his subjects an injection of the drug metrazol. The beast is held securely in this ingenious "squeeze cage." Left, noting changes in a cub's heartbeats





The lion's roar—at ten weeks of age. Some cubs will play, as at the left, while others hold back. Below, a cub fraternizes with a pup

shutter speed from the size of a dime to that of a half dollar. Roaring and clawing to get at you, he flies into tantrums of rage, exhibiting all the outward symptoms of homicidal mania. If Cooper can give a lion like Dynamite the disposition of a lamb, he will have accomplished a feat never before achieved



by a psychologist—or by anybody else.

Twice weekly for two years, Cooper has been studying the mental processes of African lions. In "psychoanalyzing" his subjects, he doesn't make them run through mazes, like rats and guinea pigs. Instead, he constantly observes their natural behavior, in fighting, playing, feeding, and mating. His keen-eyed observations at the big lion farm, jotted down in his everhandy notebook, reveal fascinating and little-known facts about the habits of the king of beasts.



Bamboo sings for his dinner. Originally coaxed with milk, he now obliges with a throaty baritone whenever mealtime arrives. At the right, another inmate of the lion farm gets a light treatment in the squeeze cage to tone muscles relaxed by idleness

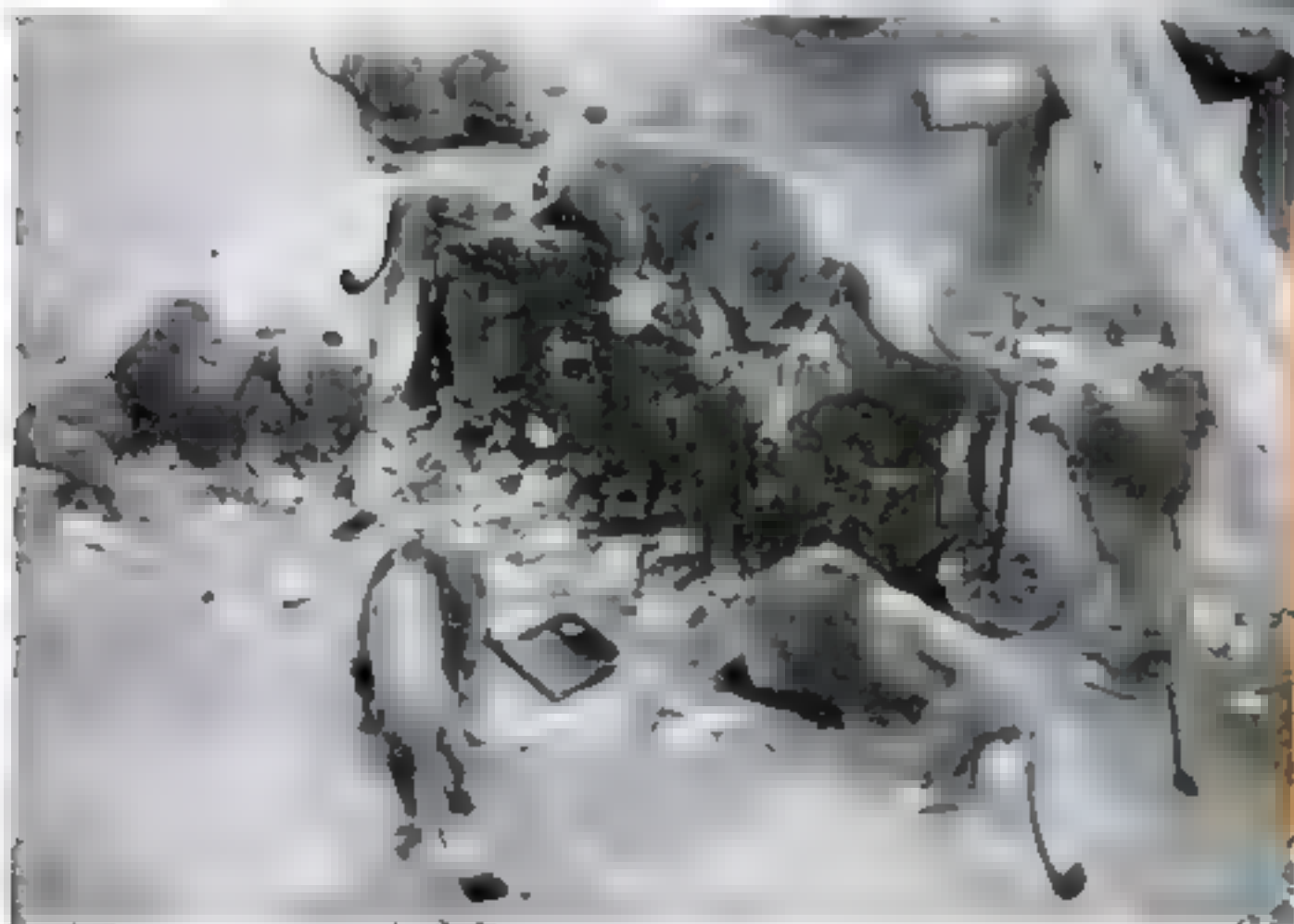


During his 1,000-hour vigil, 150 litters were born. Cubs a few weeks old, he observed, snarl ferociously—with the incongruous accompaniment of a sound like a kitten's purr. By the time their first birthdays roll around the snarl is backed up by a roar that no one could mistake.

Older lions attack unusual objects, when they are released from their cages into the open stockades. They made short work of a pair of dummies in an old car. A strange animal would meet the same fate. When lions occasionally quarrel among themselves, they first square off and box with forepaws. After one lunges, others join in.

When Cooper first came to the El Monte farm, he could tell one lion from another only by its size. Soon he learned another way to recognize them. Twenty minutes before the noonday meal—two tons of succulent horse tenderloin—one lion scratches at the steel-sheathed gate. Another, as nearly as a lion can, turns handsprings. Some sit tensely; others pace the cage.

Again, when Cooper approaches cubs sunning themselves on an elevated platform, they show marked differences in temperament. Some hang back, while the more venturesome come forward. One snaps repeatedly at his hand. Perhaps metrazol will save this budding trouble maker from Dynamite's unhappy state.



Not a hunting tragedy, but a test that shows how lions will attack unfamiliar objects. An old car and two dummies, placed in their pen, were demolished in short order. What happened to the auto suggests an assembly line—run in reverse.



Here's My Story

AT FIFTEEN I WAS A STUDENT AT BARNARD SCHOOL IN NEW YORK CITY AND A MEMBER OF THE CADET CORPS. MY FATHER WANTED ME TO STUDY FOR WEST POINT..



BUT I PREFERRED SNAKES TO THE ARMY. SATURDAYS AND HOLIDAYS I SPENT HUNTING GARTER SNAKES IN THE PARK...



I KEPT THEM IN MY ROOM ALONG WITH A BIG FOUR-FOOT WATER SNAKE. WHEN MY FATHER DISCOVERED MY COLLECTION HE TOLD ME I'D HAVE TO GET RID OF IT....



SO I EXCHANGED THE WATER SNAKE FOR A COLLECTION OF FROGS. I FED THEM WITH FLIES TRAPPED IN A STABLE AND KEPT THEM IN MY ROOM. ONE DAY THE FLIES ESCAPED AND SWARMED BY THOUSANDS THROUGH THE HOUSE. THE FROGS HAD TO GO TOO...



INSECTS WERE MY NEXT INTEREST.... ONE DAY I TOOK MY COLLECTION TO THE MUSEUM OF NATURAL HISTORY TO CHECK THE NAME OF A MOTH... THE CURATOR OFFERED ME A JOB MOUNTING SPECIMENS.



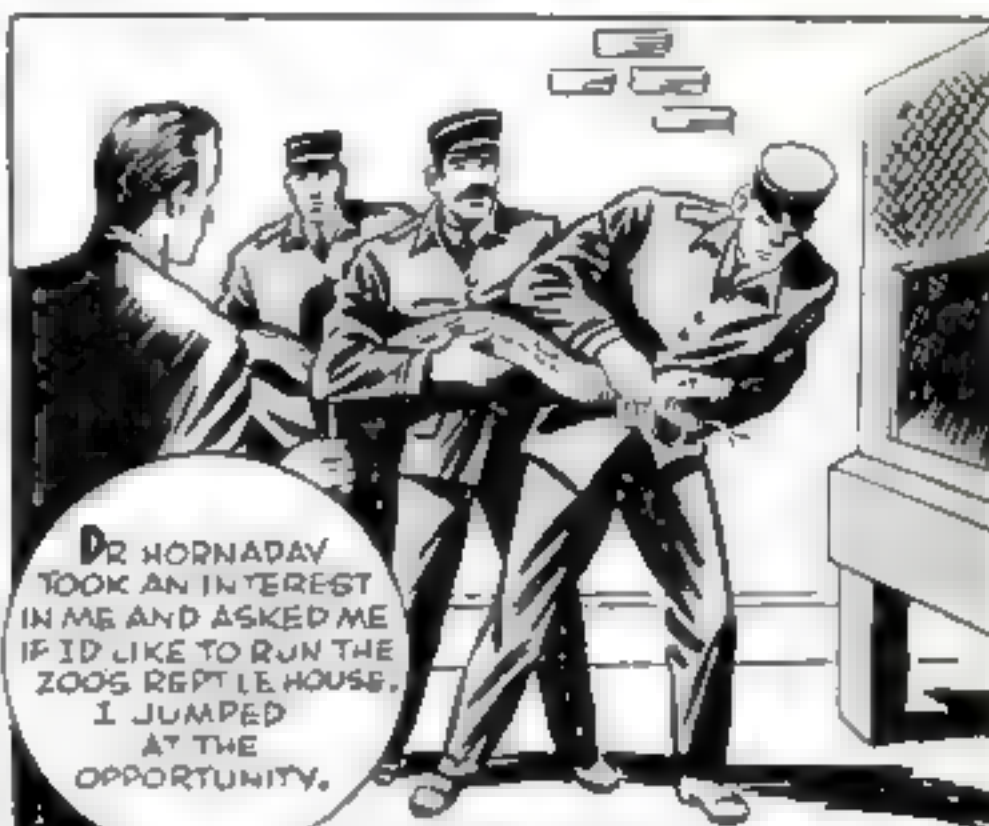
A FEW YEARS LATER I MADE MY FIRST EXPEDITION--AN INSECT-HUNTING TRIP TO FLORIDA..

THE ADVENTURE WAS LIKE ENTERING A NEW WORLD..

The ADVENTURES of a SNAKE HUNTER *by Raymond L. Ditmars*



FROM ENTOMOLOGY I TURNED TO REPORTING FOR A NEW YORK PAPER... WHILE COVERING AN ASSIGNMENT AT THE BRONX ZOO, I MET DR. WILLIAM T. HORNADAY



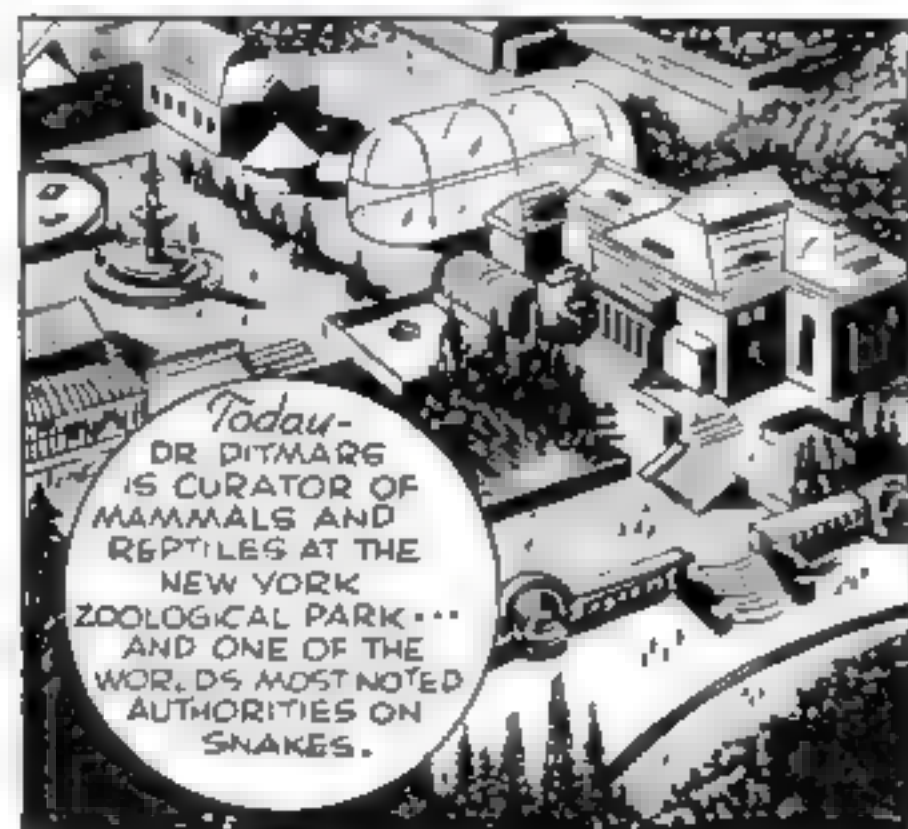
DR. HORNADAY TOOK AN INTEREST IN ME AND ASKED ME IF I'D LIKE TO RUN THE ZOO'S REPTILE HOUSE. I JUMPED AT THE OPPORTUNITY.



THE POSITION WAS SPICED WITH ADVENTURES... ONCE A BEAR BROKE LOOSE AND I HELPED RECAPTURE IT... AN ADVENTURE OF THE FIRST ORDER.



ON ONE OF MY MANY EXPEDITIONS, I CAPTURED AND BROUGHT FROM TRINIDAD A PAIR OF GIANT BATS... THE FIRST EVER TO LEAVE THEIR NATURAL HABITAT FOR EXHIBITION IN A ZOO....

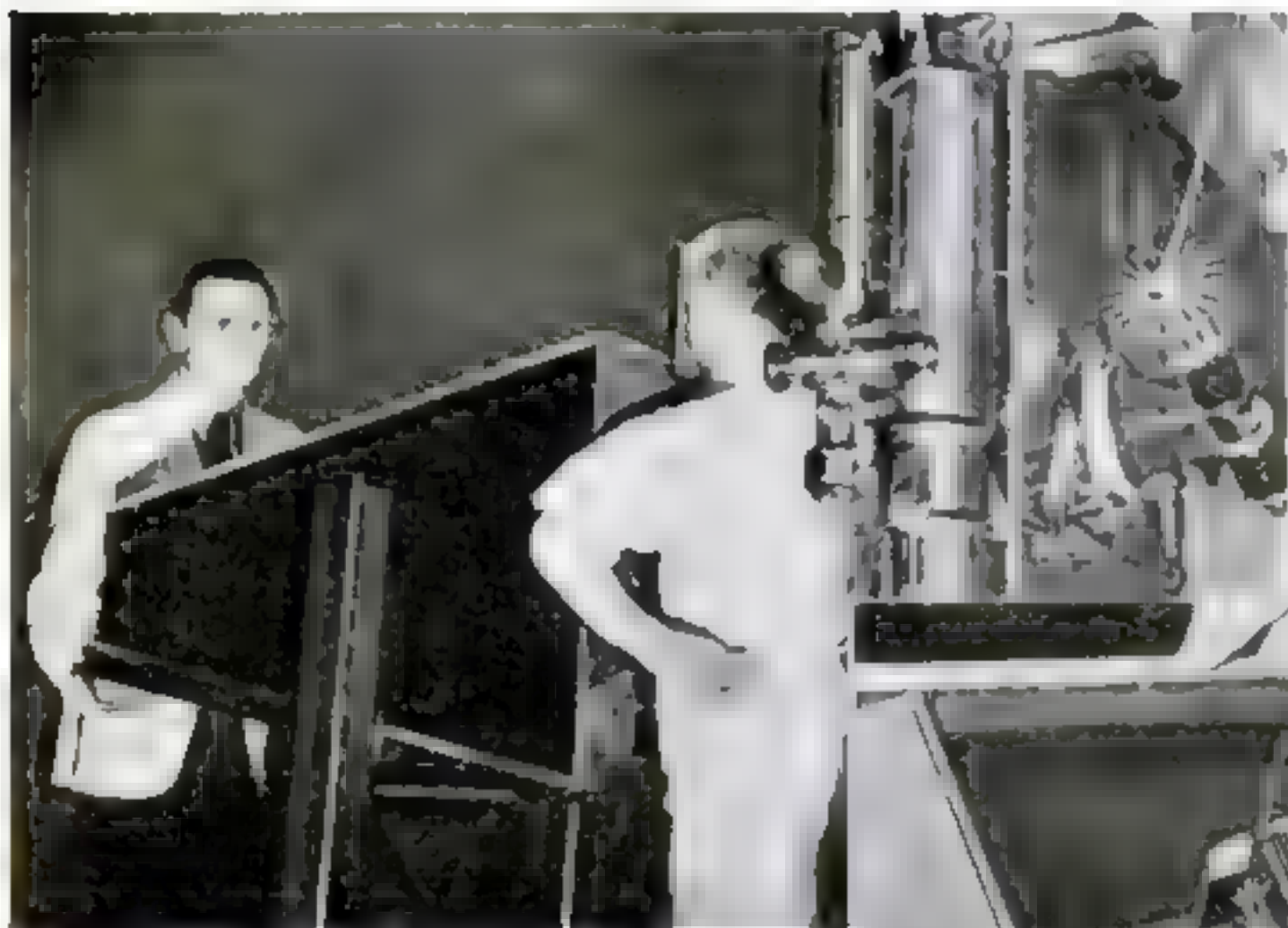


Today- DR. DITMARS IS CURATOR OF MAMMALS AND REPTILES AT THE NEW YORK ZOOLOGICAL PARK... AND ONE OF THE WORLD'S MOST NOTED AUTHORITIES ON SNAKES.

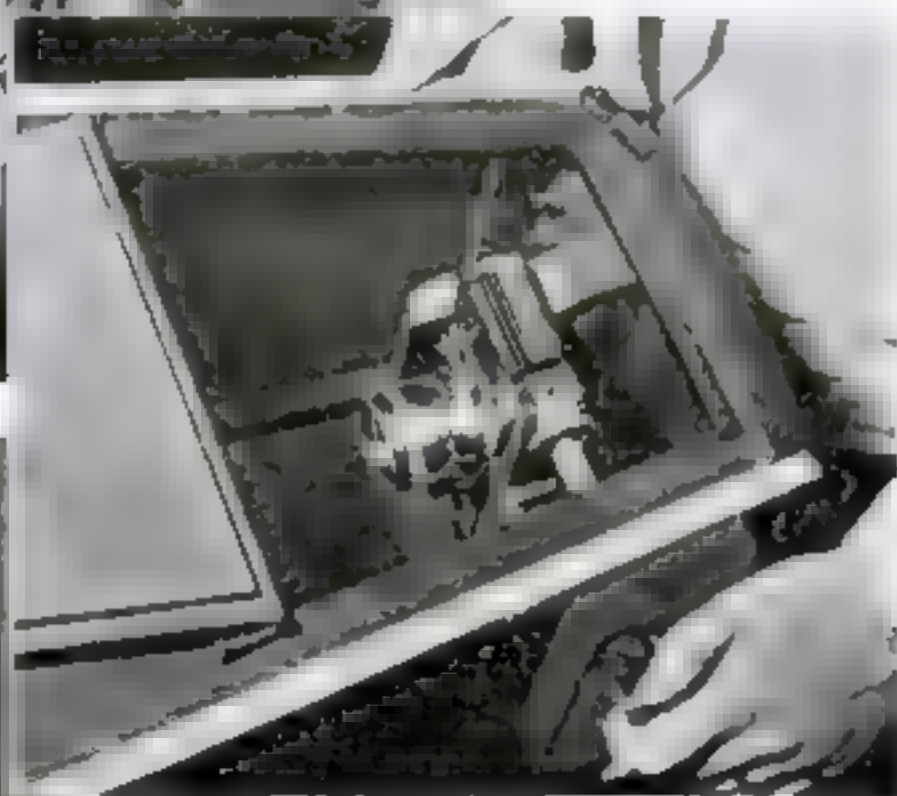
Have You a True Story?

Have you a true story that can be told in pictures? It need not be a life story; it may be a thrilling experience, or just some interesting incident. If you have, and it can be used, Popular Science Monthly will pay you for it. Simply write your story in a thousand words or less and send it along with a snapshot of yourself to Here's My Story, Popular Science Monthly, 353 Fourth Ave., New York, N. Y. If you want your contribution returned, inclose return postage.

X-Ray Camera Makes Picture for a Cent



Subject in position for making an X-ray picture of the chest. The long, black box contains the camera



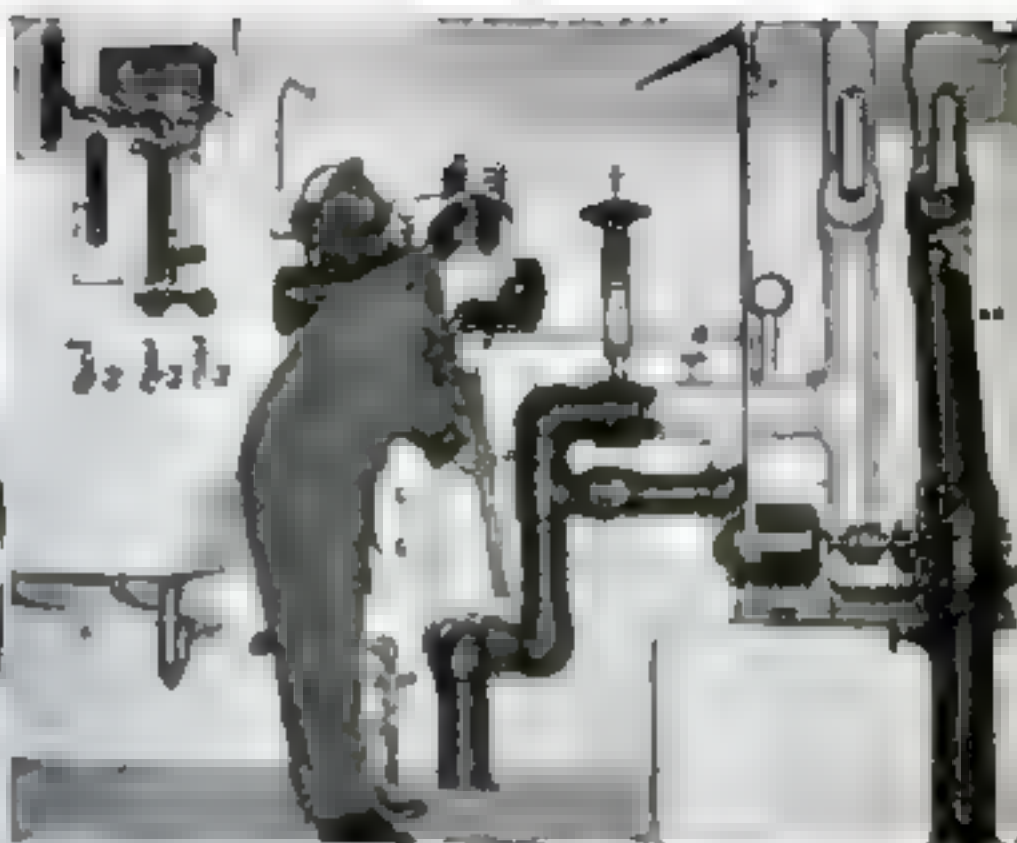
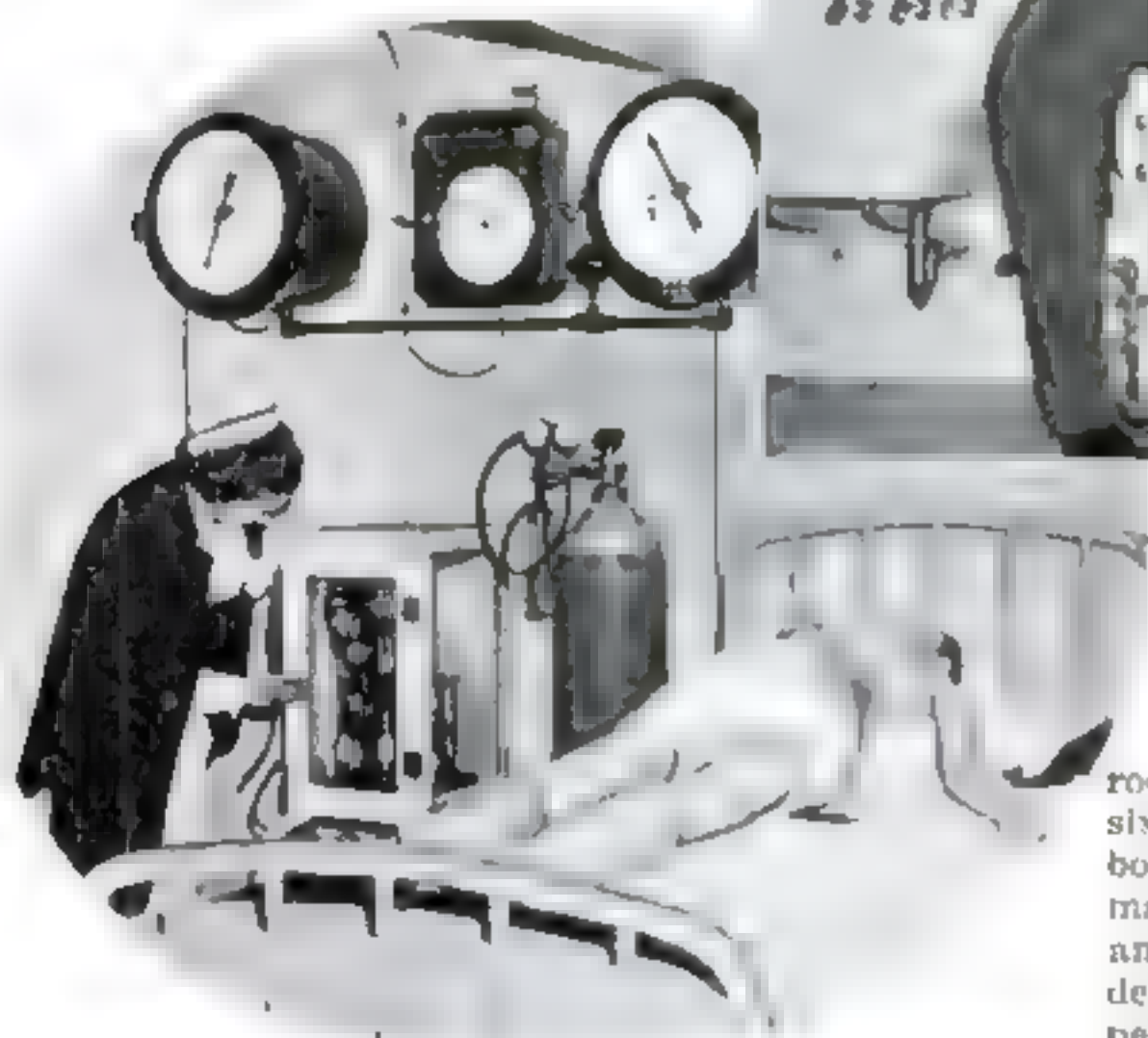
Below, the miniature camera is seen in its light-tight box. The knob at bottom turns film after each shot



Developed films are viewed with the aid of a small projector mounted on a wooden stand. This throws the image on a paper screen for close examination

X-RAY photographs, a useful but hitherto expensive aid in diagnosing diseases and injuries, can now be made at a cost of about one cent apiece. Dr. Seth I. Hirsch, of New York City, has devised a method that employs a miniature 35-mm. camera fitted with an F/15 lens and inclosed within a light-tight box almost three feet long. A shaft extends from the camera and is used to turn the film after each exposure, making it unnecessary to open the camera box. In use, the camera shutter is always left open, X rays streaming from their source through the body of the patient and the light-proof box onto the supersensitive film. For viewing the developed film, a projector mounted on a wooden support magnifies the film image by projecting it onto a paper screen for examination. The apparatus is expected to be of special value in making low-cost X-ray photographs of the human chest and abdomen.

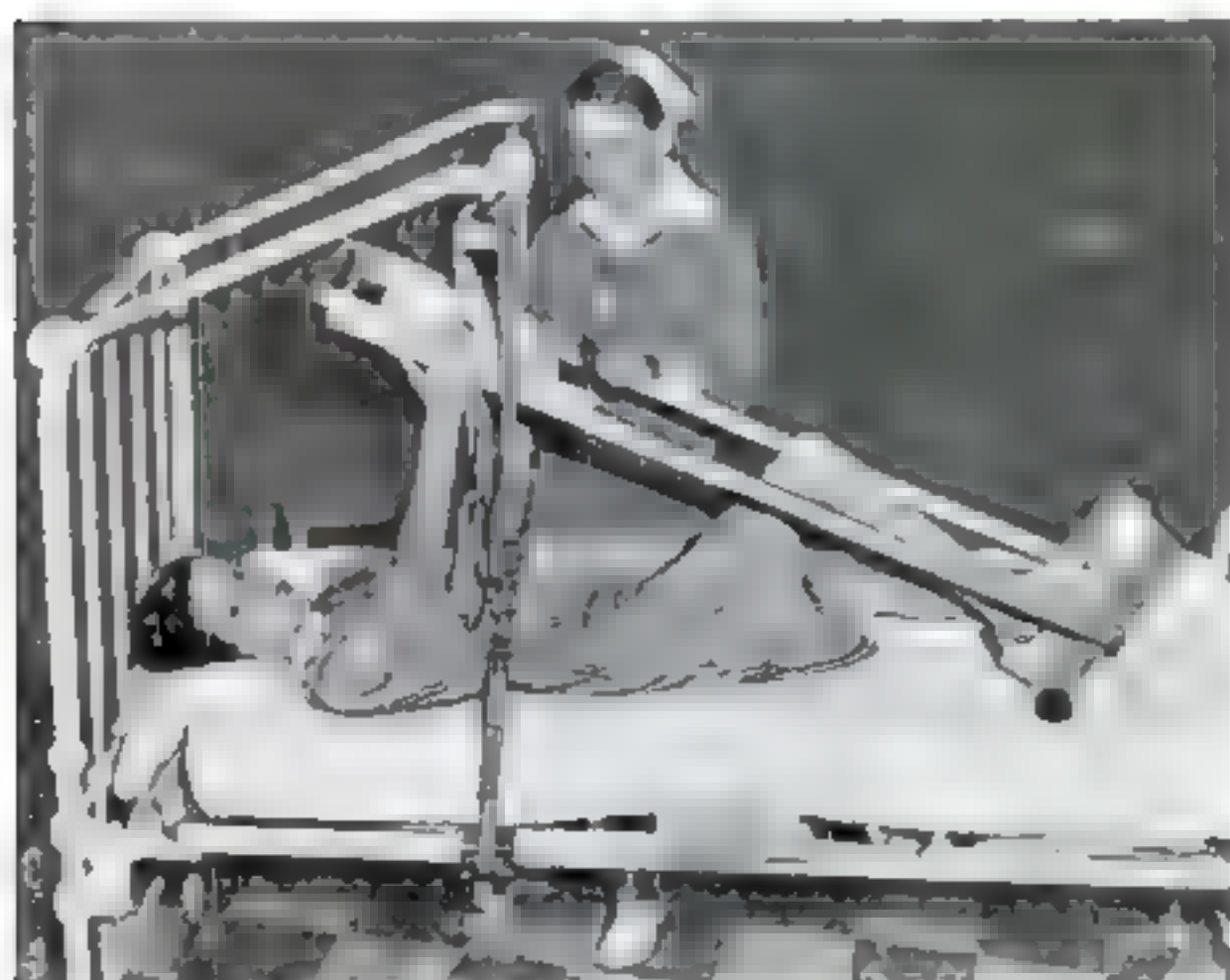
Hospital Constructs Hibernation Room for Frozen-Sleep Care



Above, the refrigerating system that cools the hibernation room shown at left as a nurse practices its use on a dummy

TO CHECK the value of the new frozen-sleep method of treating cancer (P.S.M., Sept. '39, p. 43), a refrigerated hibernation room has been set up at the Lenox Hill Hospital in New York City. Mechanical refrigeration equipment maintains the treatment

room at a temperature of about sixty-five degrees F., so that the body temperature of the patient may be kept between eighty-eight and ninety degrees, or about nine degrees below normal body temperature. A constant watch is maintained over the patient, who remains in the room for periods as long as five days, generally without feeding and in a semiconscious state, although he can be aroused at any time if necessary. The special hospital hibernation chamber is known as the cryotherapy room.



Taking this kind of exercise is fun—and good for the patient, too

Unique Bed Loom Gives Invalids Fun and Exercise

KEEPING young patients entertained while exercising their muscles at the same time is the purpose of the invalid's weaving loom pictured at the left. The invention of Margaret Gleave, a nurse at the James Whitcomb Riley Hospital for Children, in Indianapolis, Ind., the loom is operated by youngsters suffering from leg and hip diseases to help them exercise their afflicted limbs. The invention won a fifty-dollar prize for the nurse.



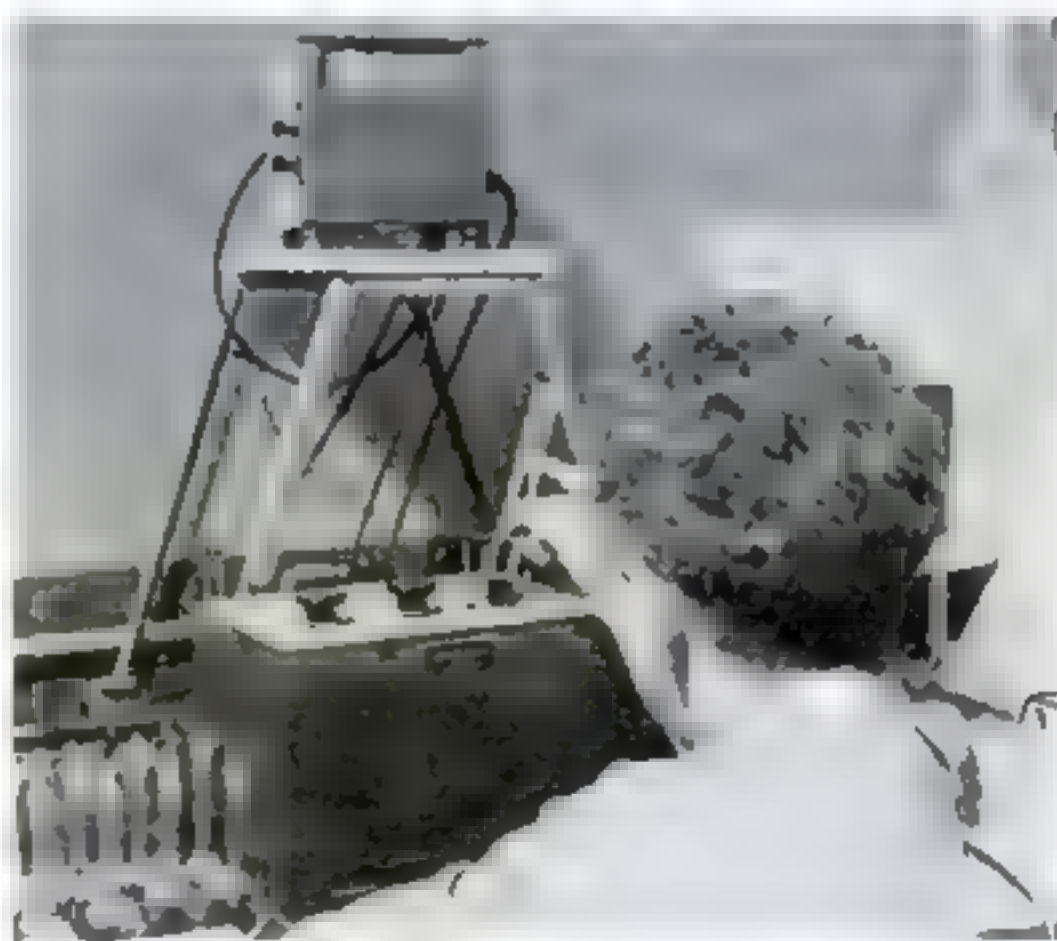
Germ-laden water in a sneeze, as shown by a high-speed camera

Study of Sneezes Aids War Against Respiratory Ills

AAAHH—CHOO! Sprayed into the air at velocities as great as two miles a minute, tiny droplets of water form a cloud around the mouth of the sneezer in the ultrahigh-speed photograph at the left, taken recently at the Massachusetts Institute of Technology, where Prof. Marshall W. Jennison is making a study of sneezing as it relates to the spread of germs that cause respiratory ailments.

New Source of Vitamins Found in Grass

COMMON grass may provide a rich source of vitamins for human consumption, according to recent scientific experiments. The grass is dried and processed by a special method to make it edible in many forms. In their grass research, scientists are using a colorimeter, an instrument that reveals the vitamin content of a substance by color.



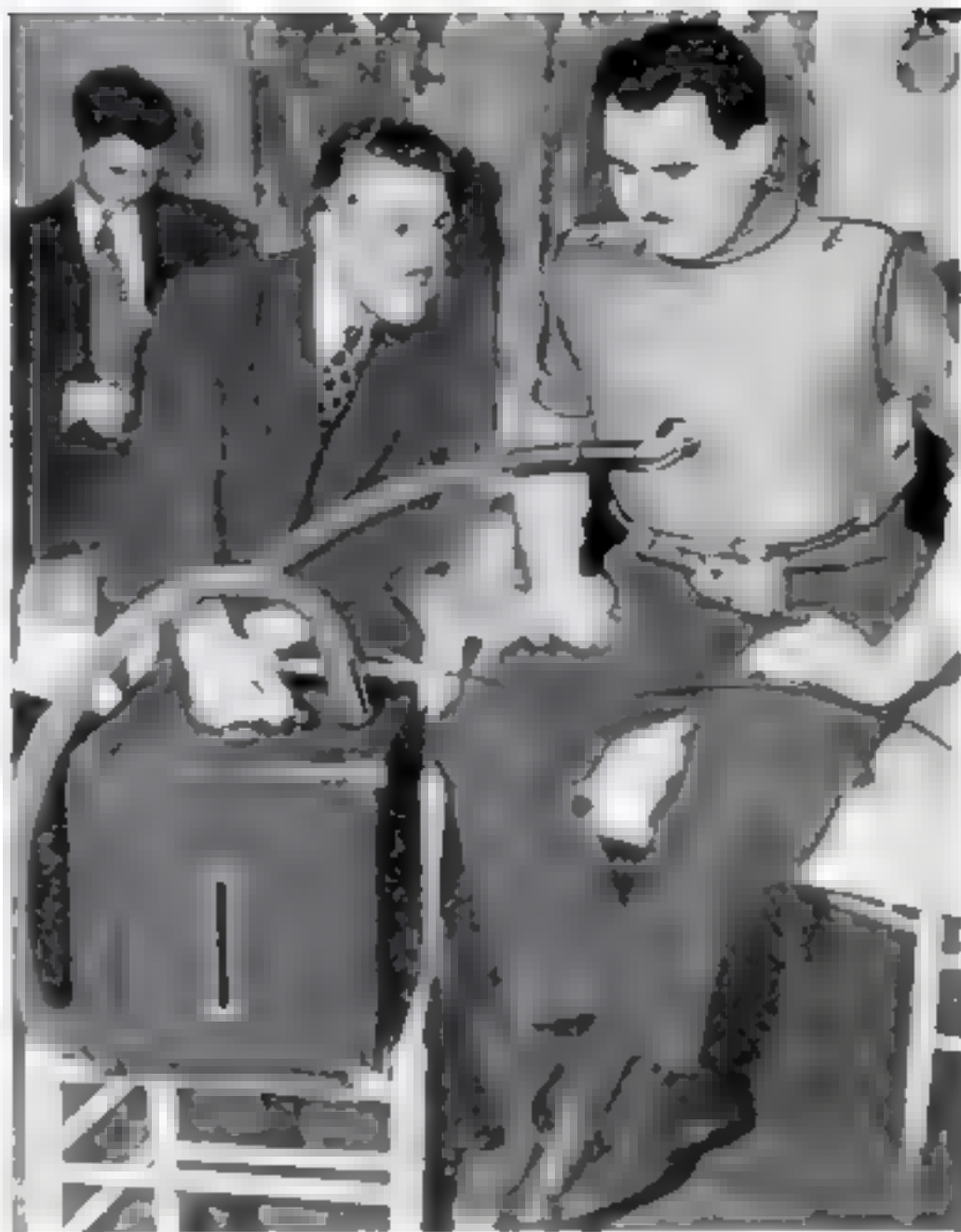
A color-measuring device checks the vitamin content of grass

Giant Suction Cups Stimulate Heart Action and Breathing

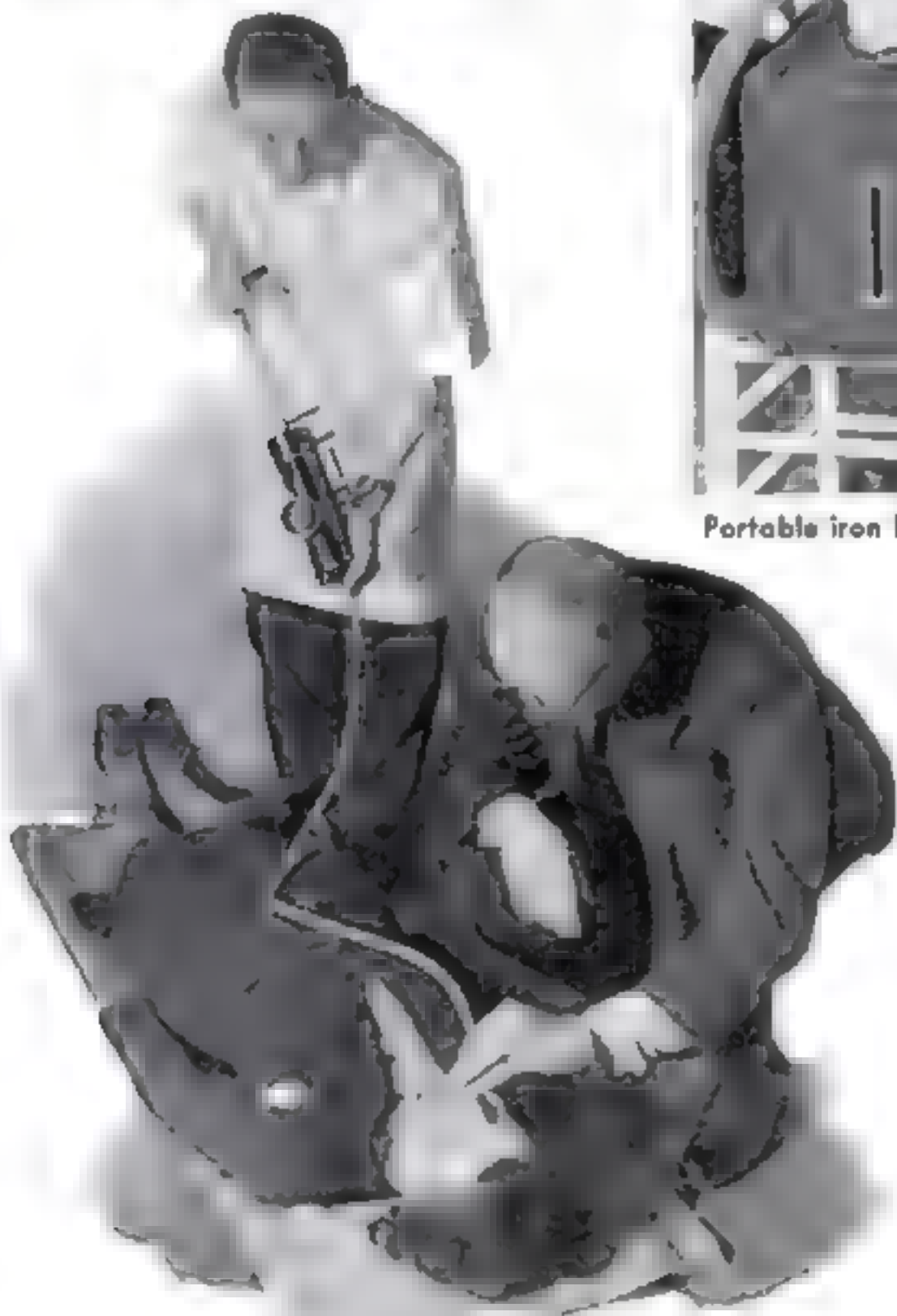
TO STIMULATE both heart and lung action in victims of suffocation by gas, smoke, or drowning, Dr. Dewell Gann, Jr., of Little Rock, Ark., has devised novel "rubber lungs." Two large vacuum cups are placed just below the shoulder blades of the victim and pressure is applied rhythmically to move the diaphragm. In addition to promoting artificial respiration, the rubber lungs are said to maintain blood circulation.

Portable Iron Lung Resembles Armor

RESEMBLING medieval armor, the metal jacket pictured at the right is part of a portable iron-lung apparatus designed by a Californian for artificial-respiration use. Rubber gaskets around openings in the steel vest make it air-tight. Compressed air, pumped into and sucked out of the device, expands and contracts the diaphragm of the patient, maintaining breathing.



Portable iron lung in use. Rubber gaskets make it air-tight



Radio Waves Kill Parasites in Pork

PARASITES that embed themselves in pork and cause the disease of trichinosis can be killed with ultra-short radio waves of the kind used to produce artificial fever, experiments at the University of Buffalo, N. Y., have shown.

Nursing Bottle Held at Correct Angle

A HOLDER recently introduced supports a nursing bottle at the correct angle for feeding an infant. The bottle may be tilted in the holder to keep the nipple full at all times.



Hand Pump Restores Breathing

LIFE-GIVING air is forced into the lungs of a patient by a hand-powered pump developed by a Swiss doctor, who expects it to be useful in treating soldiers after poison-gas attacks. The plunger pump forces air or oxygen through a tube leading to a mask held over the mouth of the patient.

Uncle Sam Remodels His Army

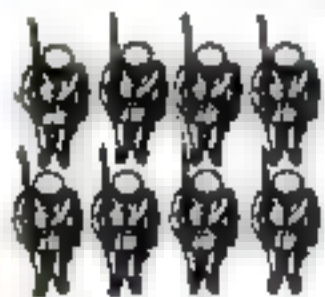
**REORGANIZATION CREATES
A "STREAMLINE DIVISION"
TO MOVE FAST, HIT HARD**

BOMBERS rain destruction down on him out of the high air, and low-flying hedgehoppers pepper him with their machine guns. Fire-belching tanks lurch menacingly toward him through early-morning battle-field mists. Field guns spray him with deadly shrapnel, and howitzers pulverize his trenches into gory ruin with high-explosive shells. In the World War he was drenched with poisonous gases and—ever a cheerful pessimist—he fully expects to be drenched with them again in the future. When he marches he plods along stubbornly under a burden of equipment, weapons, and ammunition which, in its proportion of weight of load to weight of bearer, is twice the burden of an army mule. When he fights on the defensive he keeps his head down and hopes for the best in a trench which nearly always is muddy. When he attacks he goes grimly forward against all the nerve-shattering hellishness of modern war machines protected by nothing more substantial than a tin hat.

The Britishers call him the poor bloody infantryman. The French call him the poilu. We call him the doughboy. He has won every war—barring push-overs such as the German-Polish *blitzkrieg*—which has



New Squad



Old Squad

The squad, basic infantry unit, is now composed of a dozen men instead of eight, as seen in diagrams above. In the simplified drill regulations, columns of three replace unwieldy columns of four.



By ARTHUR GRAHAME

been fought since gunpowder began to make steel-plated knights look silly toward the end of the Middle Ages. Despite airplanes, gas-engine-propelled armored fighting vehicles, high explosives, chemicals—all the products of science and of human ingenuity which have been prostituted to the uses of destruction he remains the king-pin of battle. Because only the foot soldier can both take ground and hold it, it is the infantryman that wins the local successes which make it possible for generals to win the battles which enable nations to win wars.

Over a century ago Napoleon said: "The infantry is the army." Today high-ranking American Army officers almost unanimously chorus "check" to that observation.

The fact that they agree with Napoleon doesn't mean that these officers are 100 years behind the fast-moving military parade. They have studied all the new weapons which, a few years ago, many people thought would reduce the infantryman to the ignoble rôle of a mere moppper-up, and they have experimented with most of them. They all believe in artillery—plenty of it. They all believe in airplanes, although they don't agree on how aviation should be used in war. They all believe in motorization—even the tradition-lov-

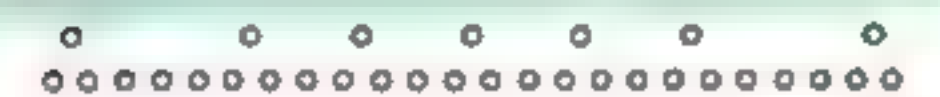


Doughboy, 1940 style. Still the king-pin of the battlefield, he gains striking power and mobility in the "streamline" division



New Platoon

Three files, each a twelve-man squad, compose the new platoon illustrated in the diagram and photo below. Left, old platoon



Old Platoon





The Garand semiautomatic rifle, at left, gives the new combat unit increased fire power with fewer men

These doughboys ride instead of marching. With its 1,357 motor vehicles, a division has amazing mobility

ing yellow-legs who want to do their fighting on horseback are glad to have their mounts carried to the scene of action in trailers. Most of them shrug their shoulders at the prospect of chemical warfare, and have no qualms about using gas if the other fellow uses it first. Nearly all of them believe in mechanization, in greater or less degree. But with the exception of a few wing-wearing enthusiasts who are honestly convinced that air power could win any war all by itself if it only were given a real chance, these men who have made a study of modern war believe that the new weapons that the machine age has given soldiers should be used for just one purpose—to help the infantry to advance. It still is the dough-boy that lands the knock-out, they say. It still is the infantry that is the core and essential substance of the army.

When we went into the World War the

organization of our small infantry divisions had to be changed to meet the demands of the murderous toe-to-toe slugging match on the Western Front, where continuous trench lines from the sea to Switzerland gave no opportunity for maneuvering. Fast footwork was sacrificed to develop a hefty punch, and the infantry division—composed of two two-regiment brigades of infantry, a three-regiment brigade of artillery, and various auxiliaries—was strengthened until in the final months of fighting its authorized strength was close to 30,000 men. Those big World War divisions moved slowly, and keeping them supplied with ammunition and food was a job which turned staff officers' hair gray, but they could take a lot of punishment, and they packed a mighty wallop.

After the World War another reorganization was indicated. What our army needed, military experts decided, was infantry divi-

Six antitank cannons like this protect the streamline division from attacks by the enemy's "hell bugs."

A machine gun is seen below in action. It is mounted on an aluminum tripod which saves weight.



sions that were small enough to move fast and large enough to hit hard.

Various staff officers went to work on the reorganization problem. One of them was George Marshall, who at forty-odd still was a Regular Army captain, although in France he had worn a colonel's silver eagles when as Chief of Operations of our First Army he had planned the withdrawal of our troops from the St. Mihiel battlefield and their transfer to the new positions from which they launched the decisive Meuse-Argonne offensive—a fourteen-day-long military juggling act which gave the German General Staff its most complete and unpleasant surprise of the war.

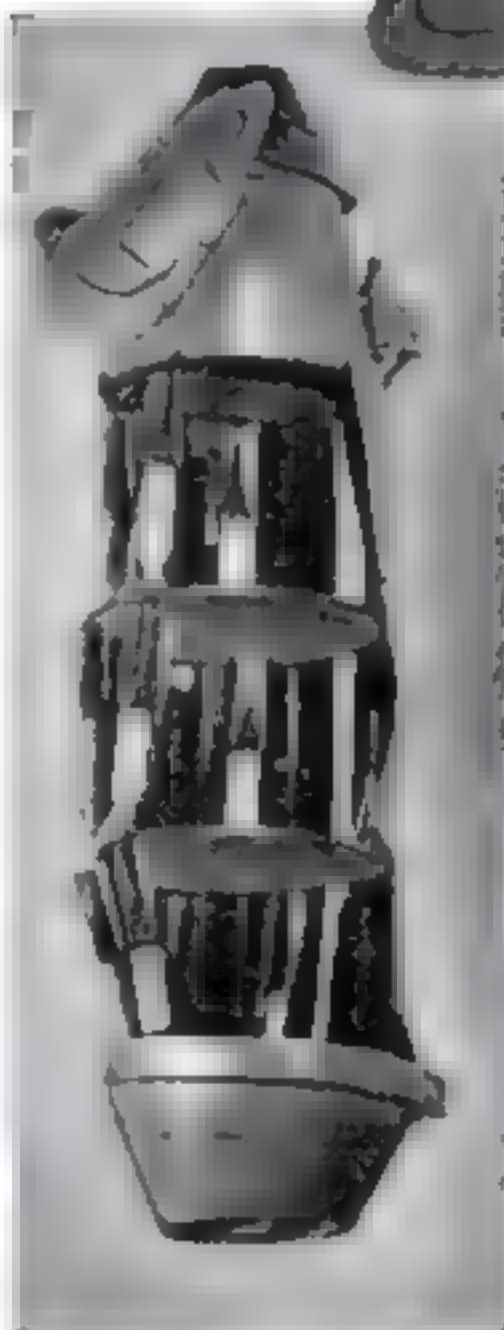
Marshall was the original army streamliner. He started with the infantry squad, and worked up. He was the father of the new simplified infantry drill regulations which enable a commander to move his men from where they are to where he wants them and get them fighting with a maximum of speed and a minimum of frills, and (Continued on page 218)

"Walkie talkie" two-way radio sets keep moving troops in constant contact with headquarters.



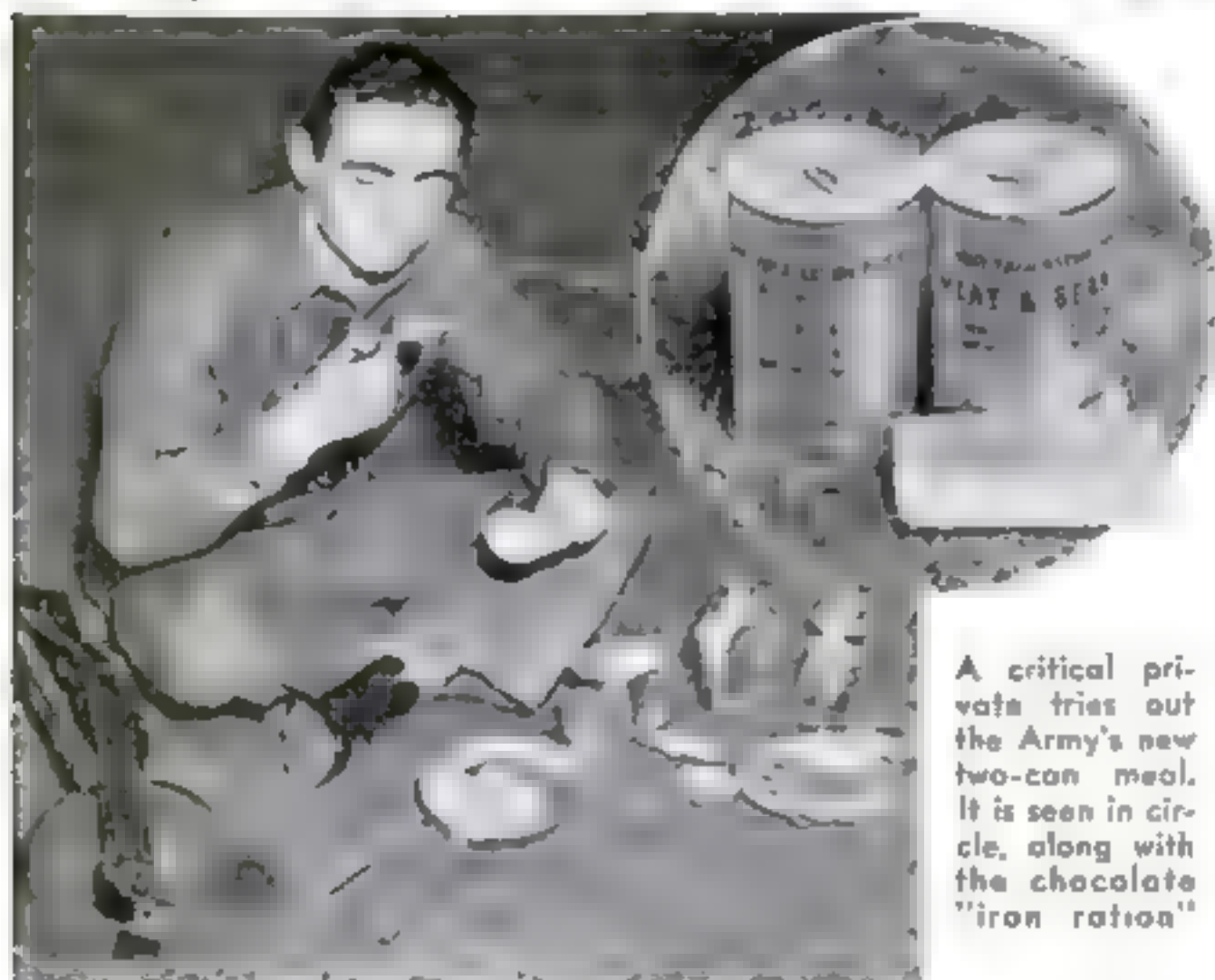
Big Russian Bomb Holds Sixty Little Ones

WHIRLING down from the sky, a gigantic aerial bomb employed by Russian aircraft breaks open before it strikes the ground, to release and spread a deadly cargo of small incendiary bombs over a wide area. Nicknamed "Molotov's bread basket," after Vlacheslav M. Molotov, Russian Commissar for Foreign Affairs, the mammoth bomb is seven and a half feet long and over two feet in diameter. Vanes at its tail cause it to whirl when released from the rack of a bombing plane. This action ultimately opens the steel sides, allowing sixty small incendiary bombs within it to hurtle outward in all directions and plummet earthward to set fire to any inflammable object on the ground within a broad circle. First used in actual warfare against Finland, the bomb was employed to set fire to towns whose houses were constructed of wood.



This huge case opens as it falls, throwing out the small bombs seen at the left

Doughboys Get New Emergency Rations



A critical private tries out the Army's new two-can meal. It is seen in circle, along with the chocolate "iron ration"

New streamline emergency rations for American doughboys have been developed at the U. S. Army Quartermaster Corps laboratory in Chicago, Ill. For soldiers cut off from regular supplies, two tin cans provide a complete meal of hash or meat and beans, water-soluble coffee, sugar, and biscuits. Even more concentrated is a vest-pocket meal made of chocolate, vanilla, oat flour, and sugar. Such an "iron ration" bar provides 600 calories of energy food. Weather-proof, gasproof wrappers protect the bars under all conditions.

Ray Gun Is Novel Weapon

SUNLIGHT and electric power are utilized in a new war machine to form a destructive ray that may have vast possibilities for military use, according to its inventor, Otto H. Mohr, of Piedmont, Calif. Machines of this type, he states, could be employed to halt or at least slow down the advance of an attacking army by concentrating their rays on the enemy's ammunition and gasoline supplies, causing them to explode. Although details of the machine's operation have not been revealed, the apparatus was tested recently before a group of U. S. Army officers. Powder poured onto the lids of tin cans was set off by the device at a distance of twenty feet. Mohr is shown at the right with his detonator-ray machine.



Otto H. Mohr with his ray gun that explodes gunpowder at twenty feet



The odd device in foreground fixes the stride for marching soldiers

Pacemaker Teaches Soldiers To March with Right Stride

THAT'S not a toy sword in the hand of the drill sergeant at the near end of the marching British troops at the left, but an ingenious spacer to maintain the regulation marching stride of thirty inches. Tips of the pacemaker, which the sergeant walks along in time with the march, are thirty inches apart.

German Army Gets New Explosive

A NEW explosive made without the use of glycerin is reported to be aiding Germany's fighting forces. Because of a shortage of fats from which glycerin is best obtained, manufacture of the substance is being pushed. It is used as a primer in gun shells, and by itself in commercial blasting.

New Explosive Packs a Deadly Wallop

DEADLIER than any other explosive yet invented by man—that is the claim of Lester P. Barlow, Stamford, Conn., for his new explosive combining liquid oxygen and a secret type of wood carbon. In recent demonstrations, it was shown that the explosive could not be set off by either flames or violent impact. When detonated electrically, however, an eight-ounce charge hurled a forty-foot telephone pole into the air and shattered it to bits.

Signal Boxes Call Air-Raid Wardens

SIGNALS sounded by apparatus installed in their homes and operated from a central switchboard at air-raid headquarters, will summon English volunteer air-raid wardens to duty in case of enemy air attacks, according to a plan now being tested. At present, wardens are called by telephone.



An eight ounce charge of the new explosive smashes a big pole



Air-raid alarm apparatus, to be installed in a warden's dwelling

Blackout Drape Ventilators

TO ADMIT fresh air through black curtains drawn across windows at night in belligerent countries abroad, lightproof ventilators are now available. Snap fasteners hold them over holes in curtains.



Ventilators snap over holes in curtains



Vacuum Cleaner for the Skin

VACUUM-CLEANING the skin is the task said to be performed by a new beauty accessory. Cone-shaped, the molded-plastic device has a base covered by a pliable-rubber massage brush, while its small end is perforated with tiny holes. To create a vacuum designed to loosen dust and dirt particles in the pores, the rubber-covered end is pressed inward, the small end placed against the skin, and the pressure released. Used after applying cleansing cream, the device is moved over the skin. It can be operated on the neck, shoulders, and arms as well as on the face.

Roulette Game Carried in Novel Compact

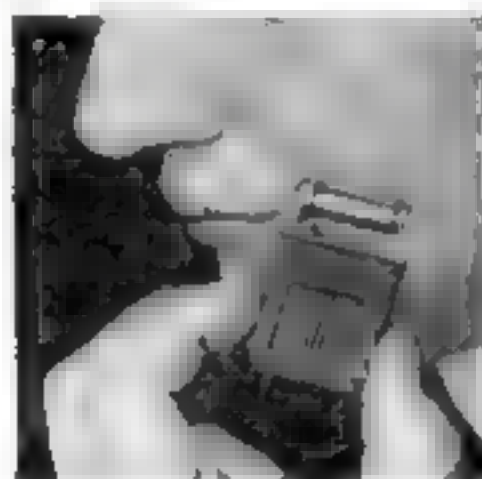
MASQUERADING as a miniature roulette wheel, a woman's compact, complete with powder, puff, and mirror, is a novelty put on the market recently. A tiny ball is free to whirl under the glass cover of the roulette compact's top, while a felt pad furnished with the beauty aid is marked off with the squares and numbering of a real roulette betting table, so that the game can actually be played with the novel outfit.



Roulette-wheel compact and folding pad for betting

New Dry Shaver Uses No Electricity

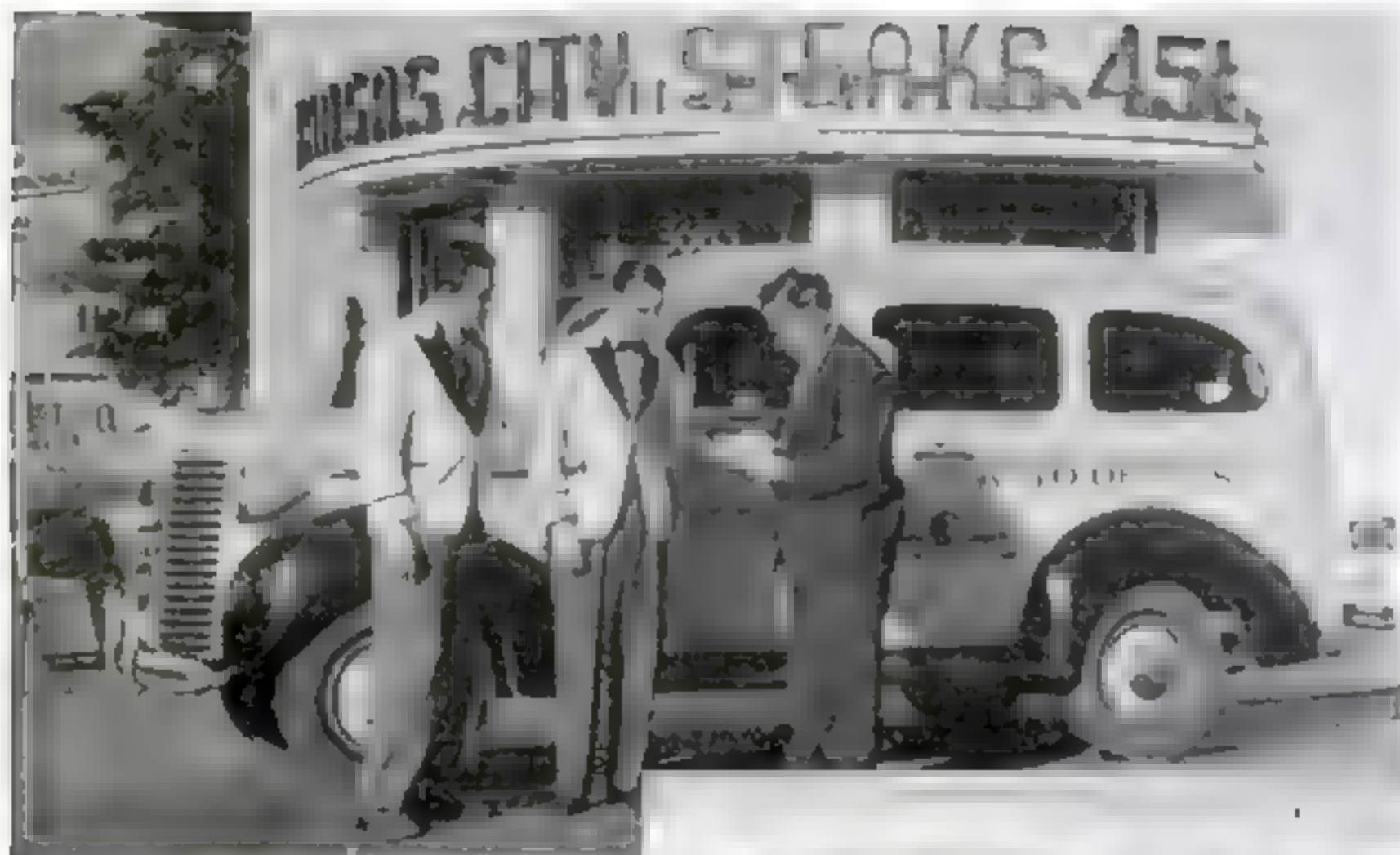
SMALL enough to be carried in a vest pocket, a dry shaver just introduced operates without electricity. The shaving element consists of a perforated cylinder free to turn on a grooved core, within which a narrow, replaceable blade is held in contact with the inside of the cylinder. In use, the shaver is moved over the skin as shown. The rolling perforated cylinder, moving past the inner blade, shears off the whiskers. Extra blades of high-grade steel can be purchased at low cost.



Heating Pad Curved To Fit

MADE saddle-shaped instead of in the conventional rectangular form, a new electric heating pad makes it easy to apply soothing heat to any part of the body. An instance of the pad's adaptability is pictured at the left, where it has been placed over the shoulder to warm part of the chest and back as well as the neck and shoulder. The pad comes in a choice of three colors, with a connecting cord and plug.

Flexible heating pad, and an example of its use for warming the neck, chest, and back at the same time



Accounting Offices Drive Right Up to Your Door

BOOKKEEPING on wheels is the odd and profitable business that makes a good living for C. M. Harris, of Los Angeles, Calif. Harris owns a fleet of light trucks, each manned by an expert accountant and outfitted as a rolling office with a typewriter, calculator, bookkeeping machine, and other necessary office equipment. Whenever a small business concern asks for the services of an accountant or bookkeeper,



AUTO OFFICES

Some 300 California small businessmen use this mobile service. Top, a unit takes over a job; lower photo, hard at work

er, Harris orders a mobile office out on the road in answer to the call. According to reports, the unique enterprise is booming, with 300 regular clients for the service.

Gift Wrappings Pay Her Bills



WRAPPING gifts in original and attractive packages is the home industry run by Mrs. Brixley Olmsted in New York City. For a modest fee, she will wrap gifts to suit any occasion—a wedding, birthday, steamship sailing, or anniversary. Mrs. Olmsted started her unusual service because she felt that most people prefer receiving an inexpensive gift wrapped in an interesting and appropriate manner, to a costlier one shoddily clad.

Art Repair Mends Sculptor's Fortunes



Sigmund Rothschild, Jr., in the shop where he mends fine art objects

REPAIRING fine objects of art is the specialty of Sigmund Rothschild, Jr., a New York City sculptor who has built up a thriving business in the field. On the job fifteen hours a day, Rothschild tackles the most complicated cases of breakage, such as delicate ceramic vases that have been shattered several times. His work includes casting, painting, soldering, and gluing of every conceivable type of material from porcelain, statuary and furniture, to metals, bric-a-brac, carvings, and oil paintings. In the photograph at the left, the sculptor-repairman is shown in his workshop, surrounded by repair jobs.

Women Trained as Handy Men

EVIDENCE that women are invading the field of home repairs traditionally dominated by the man of the house is seen in the popularity of a school of furniture repair maintained for women in New York City. Under the guidance of a feminine instructor, women learn how to repair and reupholster furniture, how to remove spots and stains, the technique of applying wood stains and finishes, and other home craftwork.



Women learning furniture repairing at a school in New York City



Vacuum Cleaners Vacuum-Cleaned

BECAUSE housewives generally hate to clean out vacuum-cleaner dust bags thoroughly, a Minneapolis, Minn., electrical shop does the job for them with a homemade machine. The bags are cleaned by a revolving brush set in an opening in a horizontal pipe, through which loosened dust is drawn off by a suction pump.

Dr. Lee Edward Travis taking motion pictures of the treatment of stammering by manipulating face muscles



THE CURE FOR STAMMERING

IF YOU STAMMER—

- 1 It's curable, so don't worry too much about it.
- 2 Refuse to be hurried in speaking. Use short phrases. Take time out for easy breathing.
- 3 Toy with a pencil, pipe, or watch charm, if the distraction helps you.
- 4 Acquire the habit of talking with face and throat muscles relaxed. Swallowing helps relieve tension.
- 5 "Let down." Seek a calm home and business life. Lie down and rest whenever you can. Particularly, avoid quarrels and other emotional disturbances.
- 6 Keep yourself in perfect physical health.
- 7 If possible, get in touch with a recognized speech-correction clinic.

In the two photographs at the right, brain waves are being studied. Electrodes are taped to the scalp of the subject, who relaxes in a screened room. Impulses are recorded on paper

WITH phonograph recordings, a new kind of lip training, and delicate electric brain-wave detectors, scientists are waging a winning war on stammering. Their researches mean new hope for the 1,000,000 or more Americans who suffer from the ailment.

Do you stammer? Whether you do or not, you can join the nation-wide fight to end the personal suffering and the \$1,000,000,000-a-year economic loss caused by disordered speech. Experts have



By R. DeWITT MILLER

now discovered such simple methods of treatment that nearly anyone can cure himself, or show a friend how to do it.

These findings spring from the latest work in speech-correction clinics throughout the country, where every modern scientific weapon helps treat even the most refractory cases of stammering. Enter one of the most advanced of these institutions, headed by Dr. Lee Edward Travis at the University of Southern California, and you will see how research and actual treatment go hand in hand.

First, the subject speaks into a microphone, while a phonograph disk makes a permanent record of his voice. This serves a double purpose. Played back subsequently, it encourages him by showing him the progress he has made under treatment. With hundreds of other records, it also enables research workers to compare different types of stammering. Cases range from persons who barely stammer to others whose stammering spasms last as long as half an hour.

Brain waves, the faint electrical impulses that reveal a person's nervous make-up, are being studied as a possible help in diagnosing cases of stammering. In recording them, a subject lies relaxed within a room inclosed by copper screens to shield the ultrasensitive electrical instruments from outside influences. As many as ten electrodes, with wires leading to recording apparatus, are attached to his scalp. Then an amplifier magnifies the brain currents, so that they may be recorded in a wavy line on an endless tape. A normal person gives a pattern resembling a fairly regular row of saw teeth. In the extreme case of a brain tumor, the line wavers aimlessly all over the chart. Experimenters hope to find intermediate sorts of brain waves, characteristic of various classes of stammerers, and thus link impaired speech with other types of nervous disorders.

Manipulating facial muscles, a new treatment



Teaching a child to pronounce the word "from" by the method shown in the picture at the top of the opposite page. A separate movement forms the lips for each of the three successive sounds of "f," "rah," and "mm"



HOW PHONOGRAPH RECORDS AID IN THE WAR ON STAMMERING

As the subject speaks into a microphone, a permanent record of his voice is made on a disk. This can be played back subsequently to show him the progress he has made in overcoming his speech defect. It also is useful for study by research men



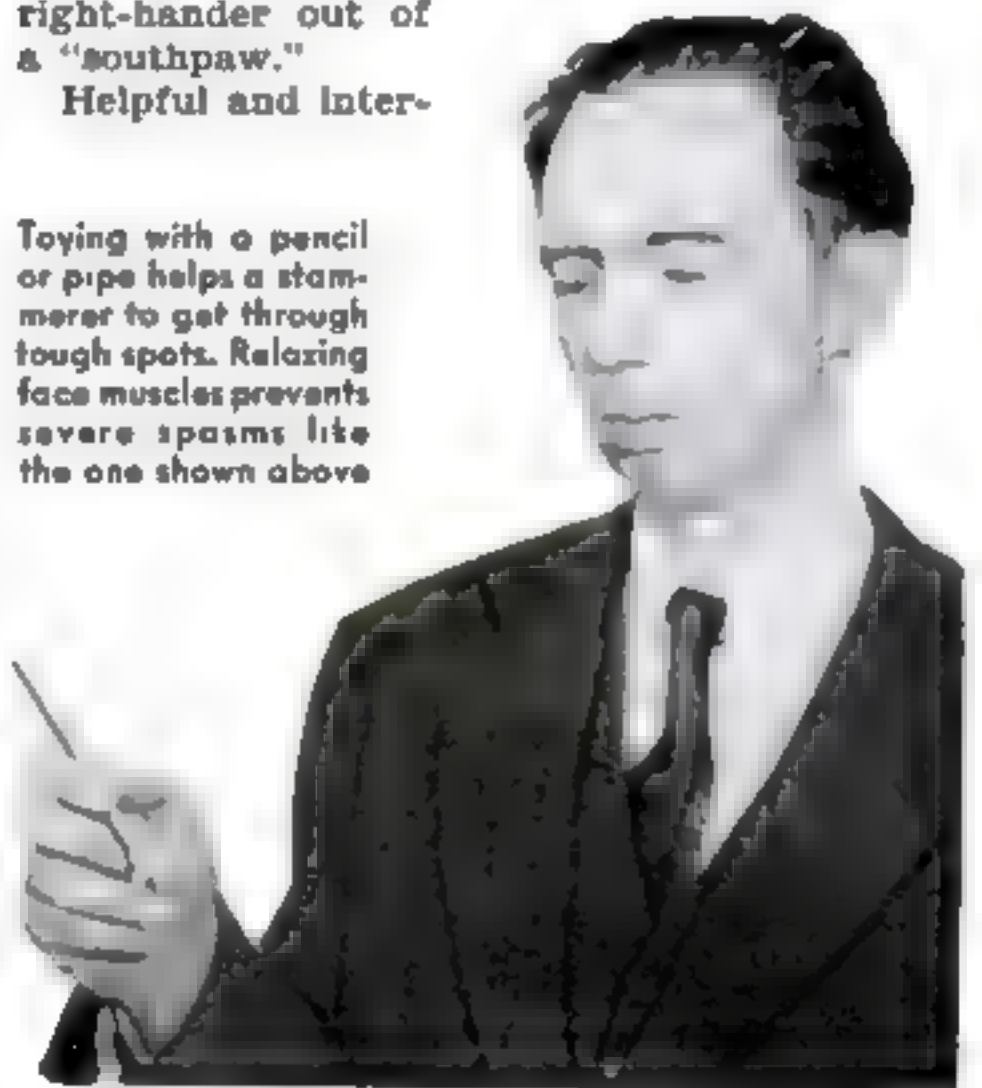
developed by Mrs. Edna Hill Young and elaborated upon by Dr. Travia, helps overcome severe stammering. Even backward children unable to utter a word have been taught to speak. With deft fingers, the "trainer" shapes the subject's lips so that nothing but the correct sound can possibly come out. Thus a patient, who previously could be trained only by visual and hearing aids, now experiences the exact "feel" of pronouncing a syllable. So successful has the method proved that the Rockefeller Foundation has financed large-scale training of operators for clinics.

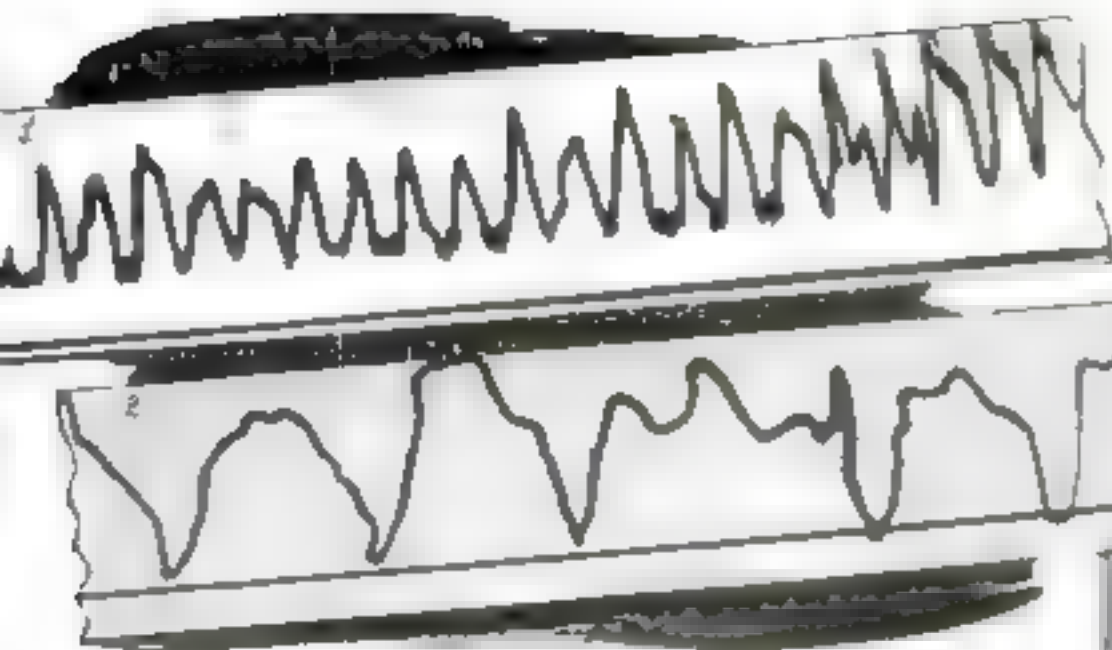
Stammering usually begins in childhood and parents should be on the watch for it, experts say, since an immediate cure is much easier than a later one. Generally, a young child stammers because he has been forced to change from a left-handed to a right-handed way of doing things. Specialists explain that the left hemisphere of the brain

controls the right side of the body, and vice versa. One of the two brain hemispheres always is "dominant." Disturbing that dominance, before it has fully developed, produces mental confusion and affects the brain center of speech, causing stammering. After a boy or girl is sixteen years old, however, the dominance of one side of the brain is firmly established, and no harm can be done in making a right-hander out of a "southpaw."

Helpful and Inter-

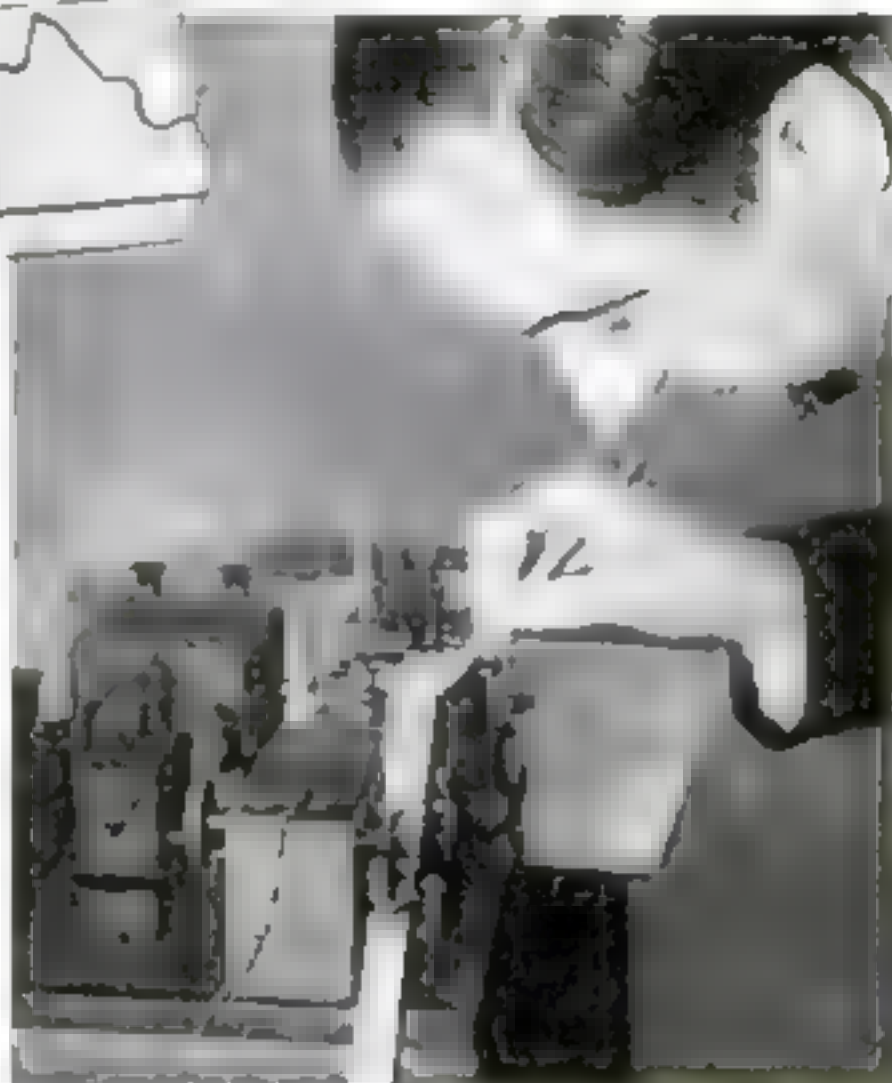
Toying with a pencil or pipe helps a stammerer to get through tough spots. Relaxing face muscles prevents severe spasms like the one shown above





Brain-wave records and, below, the instrument on which they are made. The upper tape shows normal brain impulses; lower indicates presence of brain tumor

esting conclusions for adults also emerge from clinical observations of thousands who trip and stumble over their words. Get one of them good and mad, and he will forget to stammer! Evidently there is nothing wrong with the mechanical parts of his speaking organs. His real trouble might be likened to "static" in the control line linking the brain and the vocal muscles. Usually this results from undue nervous tension. Once a stammerer learns to overcome his nervous condition, or remove its cause, self-cures are readily possible. Thus anyone can regain and enjoy to the fullest his most human faculty, speech.



Built-Up Shoes Make Short Men Taller

SHORT men no longer need be at a disadvantage in watching parades, or in reaching for something on the top shelf. To their rescue comes a New York shoe designer, whose footwear is said to produce an "invisible lift" of one to two inches without sacrifice in stylishness. Forestalling the

natural impulse to tear the shoe apart and discover his secret, he exhibits a cut-away model that solves the mystery. A comfortable, skillfully shaped insert raises the foot from the ground without appreciably altering the external contour. Customers include "shorties" who want to see eye to eye with other men or with girl friends, and who gain self-confidence and social ease with increased height provided by the novel footwear.

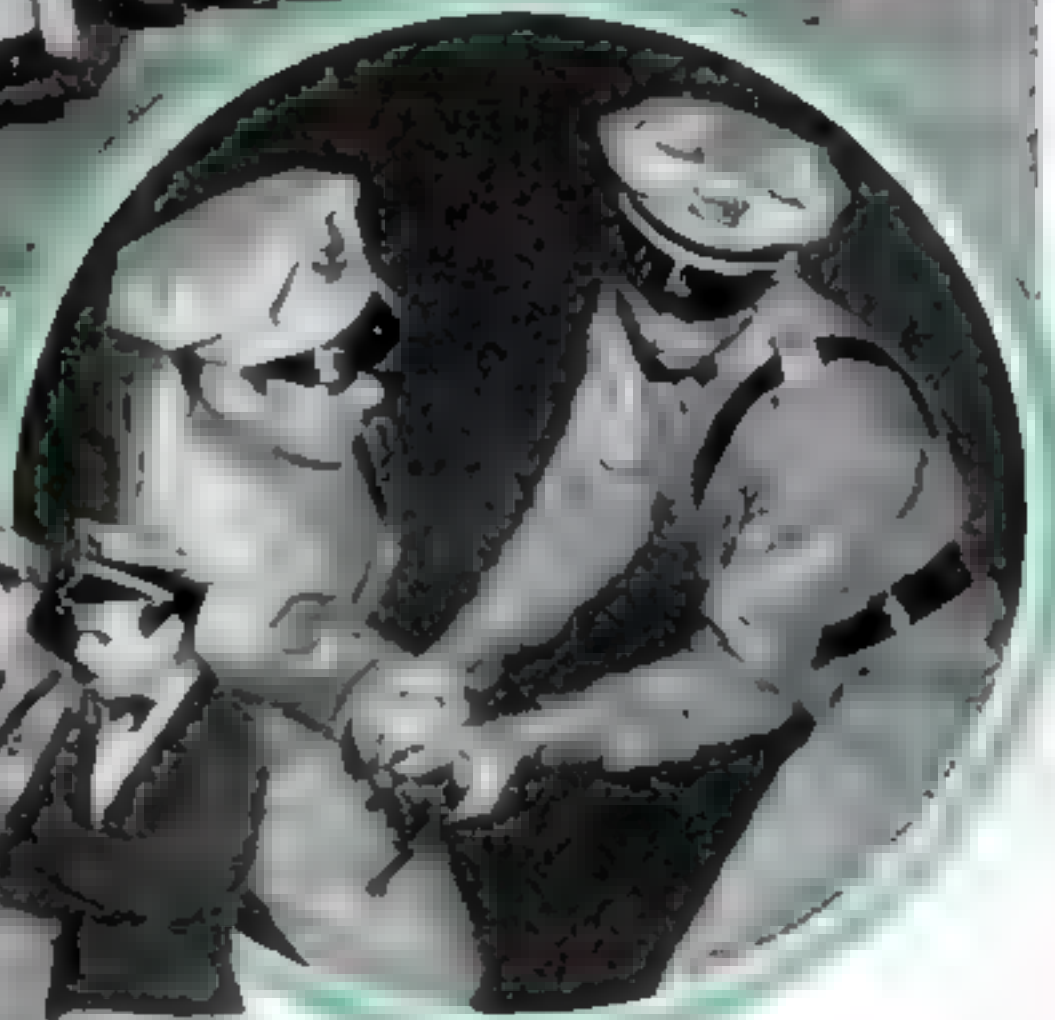


The long and short of it: a shoe with invisible lift contrasted with ordinary footwear. Cut-away view at right shows how height is built into a shoe

BOY SHERIFFS



'Tuck it in!' A junior deputy lieutenant and Horace Roberts, adviser, inspect Los Angeles County junior deputy sheriffs



Stripping a bandit of his gun is an early lesson for these young California crime fighters. They get their training from experts

An instructor shows a group of young deputies how to overpower a larger opponent in an emergency with a handy judo hold

By MARSHALL PERHAM

At their headquarters, the junior deputies built this two-way, short-wave radio station themselves for dispatching and taking orders



Here a demonstration in first-aid technique is being put on as part of the regular training. Below: Although they don't carry guns, they are good marksmen



NO MORE does the familiar cry of "Hey Skinnay, come on and play cops and robbers!" echo through the neighborhoods of Los Angeles County. The game has ceased to be a sport, and is now a serious business. The call now sounds over the short-wave air lines, and is something like this: "Calling all Junior Deputies all Junior Deputies—report to your sergeants at the Hollywood substation for duty in the forest-fire area."

Acknowledgments pour in, and presently boys of from fifteen to twenty-one are arriving at the sheriff's substation, wearing the uniforms and badges of deputy sheriffs of Los Angeles County. In a few minutes they have loaded necessary equipment on trucks, and are speeding down boulevards, sirens clearing their way.

At the scene of the fire, they take charge of duties exactly like those of the senior deputies. One thoroughly trained group handles first aid for the injured. Others take charge of feeding and sheltering those rendered homeless. Still others take over policing duties.

At first glance, these young officers appear hardly capable of handling police duties. Decidedly not the



Stretcher bearers up! During emergencies, this duty is indispensable

bruiser type, they are just typical young Americans of high-school age. But woe betide the person who tries to get tough with them. Their training has included methods of handling such persons, and they know thoroughly all the ways and means of overcoming those physically superior to themselves. Though they carry no arms, they are trained marksmen, and they know the traffic laws and the penal code thoroughly.

It was largely through the efforts of Capt. R. A. Cook, of the Hollywood substation, that the organization came about. Captain Cook had found that new deputies came into the force with very little idea of how to perform their duties. Training them was expensive and took time. In addition, there was considerable juvenile crime and delinquency in certain districts, largely due, he felt, to the fact that ambitious boys of high-school age had no organization to keep them off the streets. So, he reasoned, bring them

into the sheriff's office and train them.

Sheriff Eugene Biscailuz was so pleased with the idea that he sponsored the first twenty boys. It cost him a hundred dollars, out of his own pocket, to buy the badges. He feels now it was cheap at ten times the price.

Meanwhile, financial backing began to come from fabulous Hollywood. Actress Joan Crawford learned of the new organization, contributed generously, and urged her friends to do the same. Contributions poured in from all over the country.

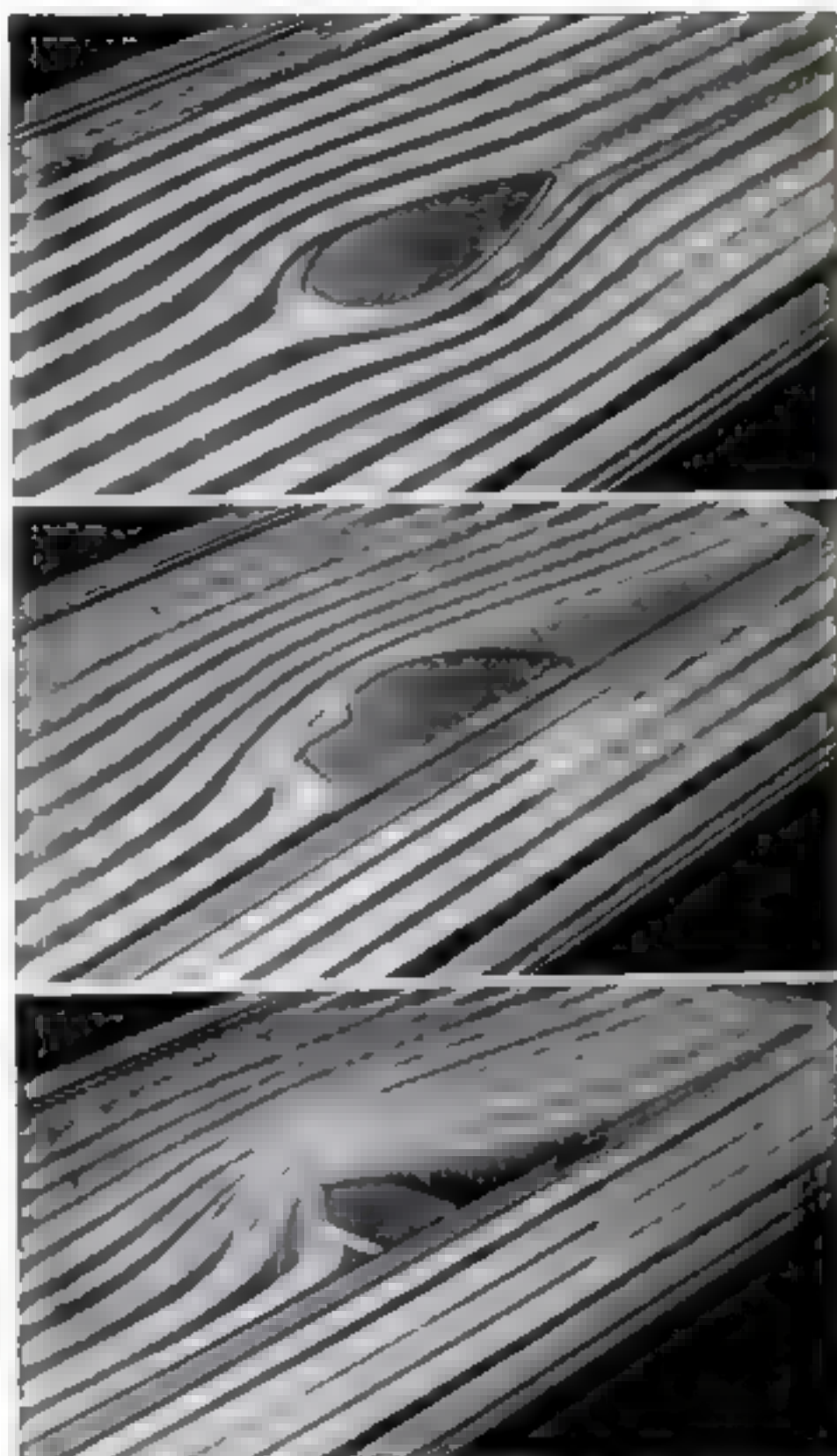
It then became up to the boys to justify the confidence placed in them. Under command of Inspector Louis Bennett, and Horace Roberts their chief counselor, they began intensive training. Presently they were putting their knowledge into practice. They have served well in their duties. But, best of all, they seem to have put an end to juvenile crime in their district.



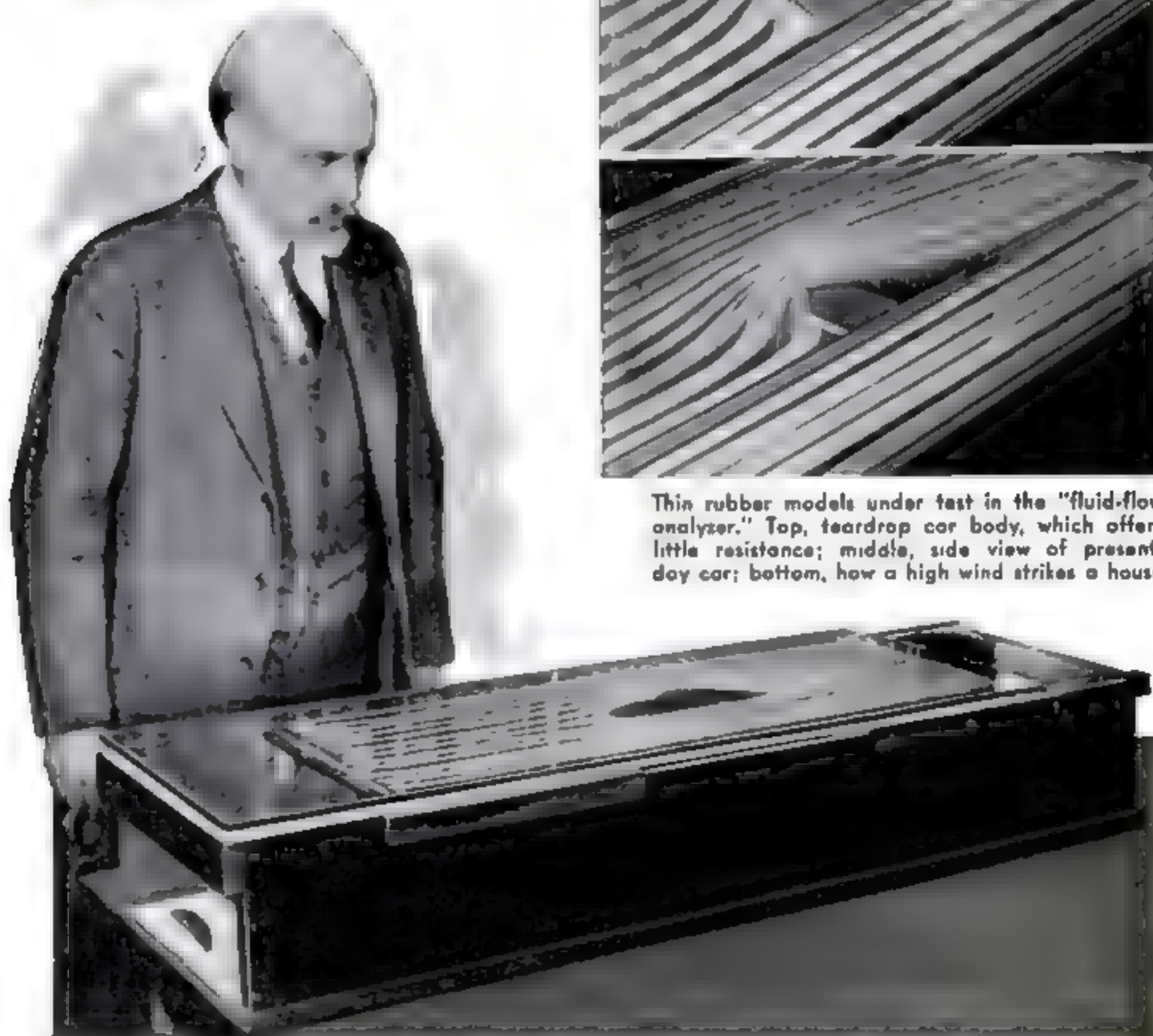
It's not all work, specially at initiations. When this rookie can keep his body stiff, they will stop

Smoke Ribbons Test Streamline Design

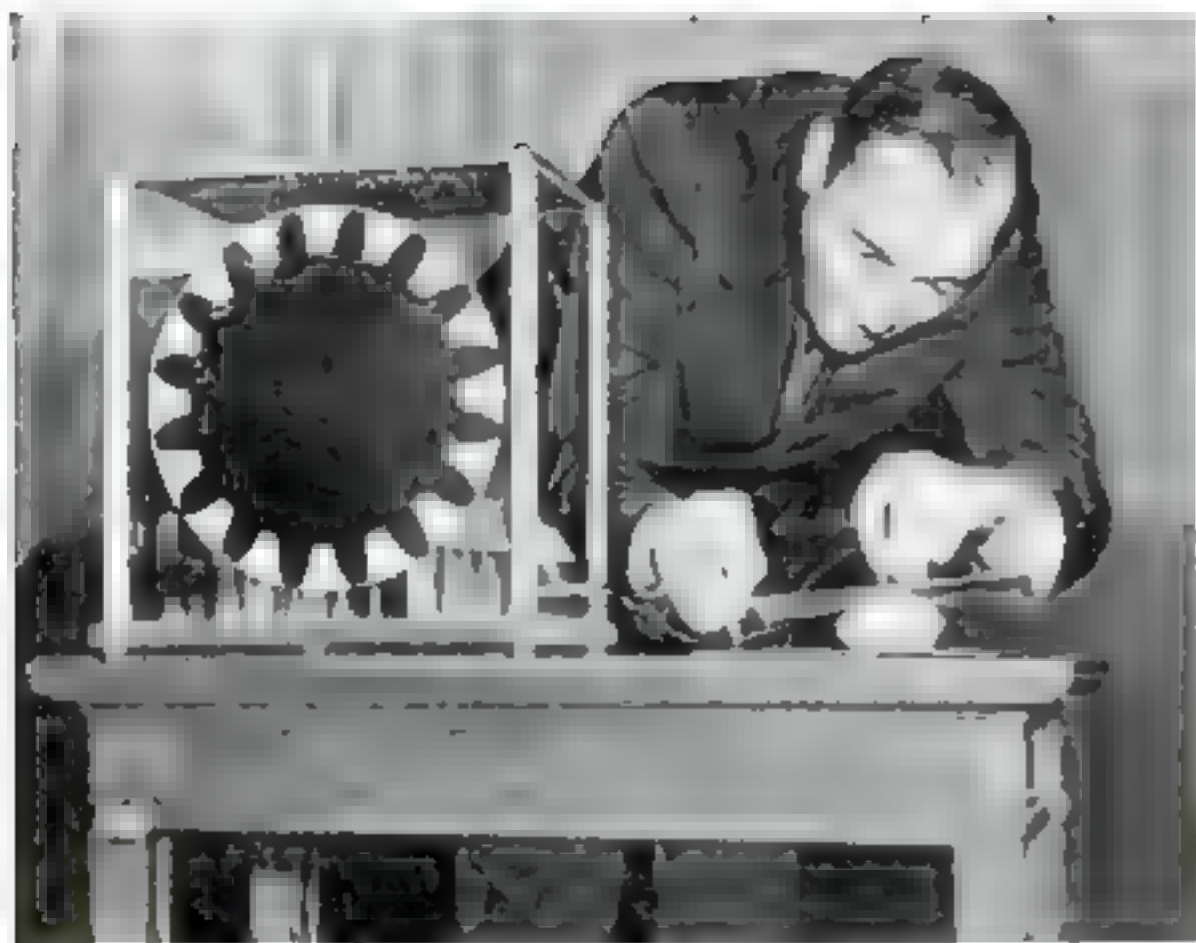
MODELS cut from sheet rubber only a quarter of an inch thick are used in streamlining experiments now being carried out with the aid of a new "fluid-flow analyzer" devised by Prof. Harry L. Parr, of Columbia University, New York City. Taking the place of an elaborate wind tunnel, the apparatus, only four feet long, one foot wide, and seven inches high, is suitable for use in any small laboratory. After the rubber models are secured between two sheets of glass, set a quarter of an inch apart, ribbons of smoke are drawn swiftly through the space between the sheets by means of a high-speed electric fan. Any disturbances in the air stream passing around the models can be photographed easily through the glass.



Thin rubber models under test in the "fluid-flow analyzer." Top, teardrop car body, which offers little resistance; middle, side view of present-day car; bottom, how a high wind strikes a house



Prof. Harry L. Parr with his compact laboratory apparatus which takes the place of a large wind tunnel



Lemon Supplies the "Juice" for Tiny Motor

LEMON juice provides the power that operates a delicately constructed electric motor designed by William A. Gluesing, of the General Electric laboratories, at Schenectady, N. Y. The lemon is cut and placed between sheets of copper and zinc. Its acid juice acting on the metals produces a natural galvanic cell that generates a flow of current sufficient to spin the wheel of the sensitive motor. The lemon-power motor is currently on exhibition at the New York World's Fair.

When the plates contact the lemon, the disk at left starts turning

Models Strange Sea-Bottom Creatures

LIFELIKE reproductions of sea anemones, the colorful, sedentary ocean-bottom creatures which are sometimes referred to as "the chrysanthemums of the sea," form an interesting natural-history display designed and constructed by Mrs. Dorothy Olsen Johnston, of West Nyack, N. Y. After descending in a diving helmet to study the flowerlike creatures in their natural surroundings on the sea bottom, Mrs. Johnston began reproducing them in realistic poses and colors. She molds the bodies from wax

and makes the graceful tentacles of transparent cellulose material. Bars of this material are heated in water to soften them before they are bent and sculptured into lifelike positions. Coloring is accomplished with a brush and spray gun. When each reproduction is completed, it is placed in a natural setting of tropical coral which previously has been bleached, washed, and appropriately tinted.



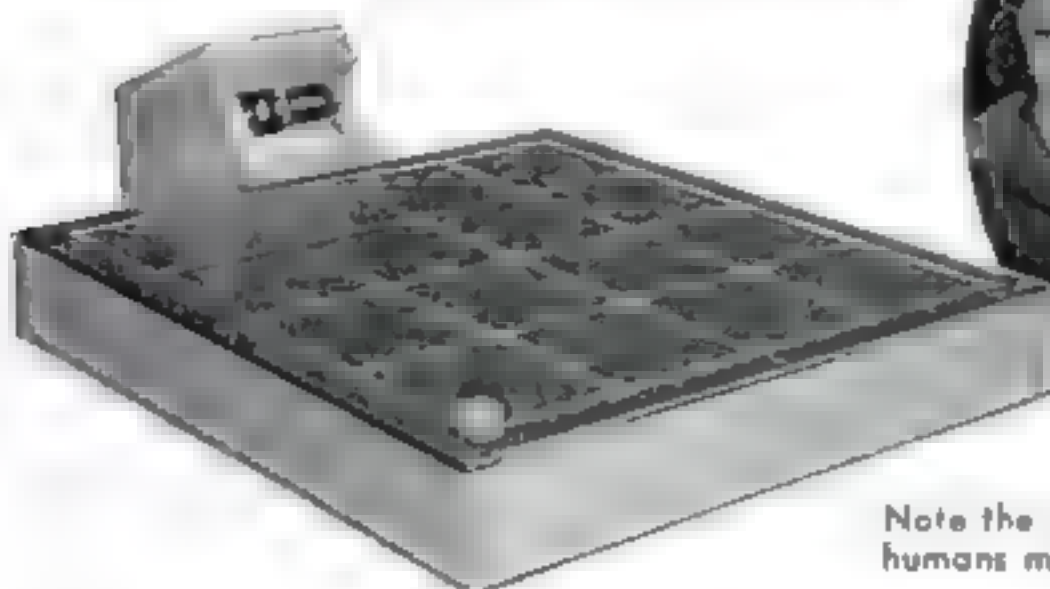
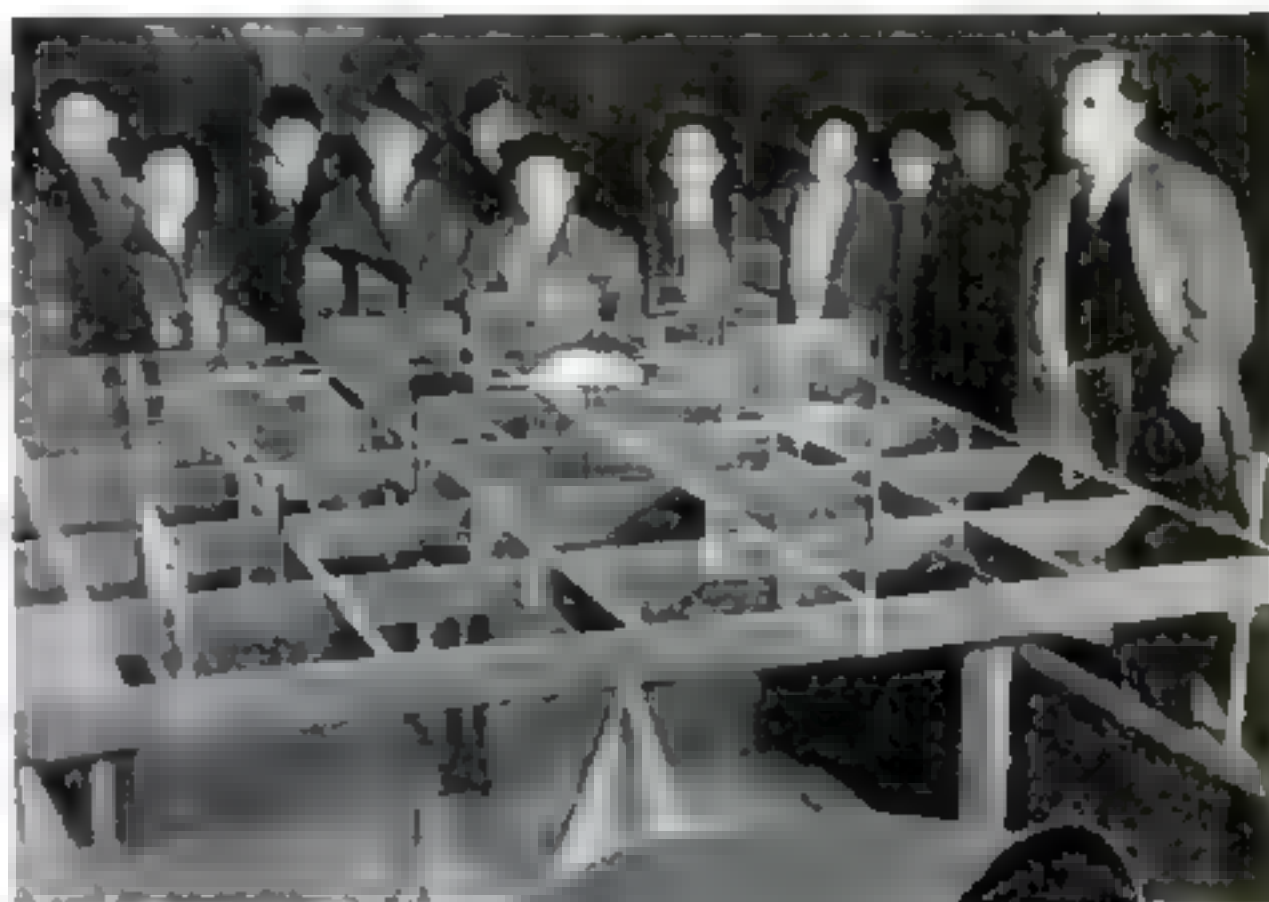
Mrs. Dorothy Olsen Johnston puts the finishing touches on a sea anemone



Helmeted for diving, she sets out for the sea floor for close-up view of natural marine life

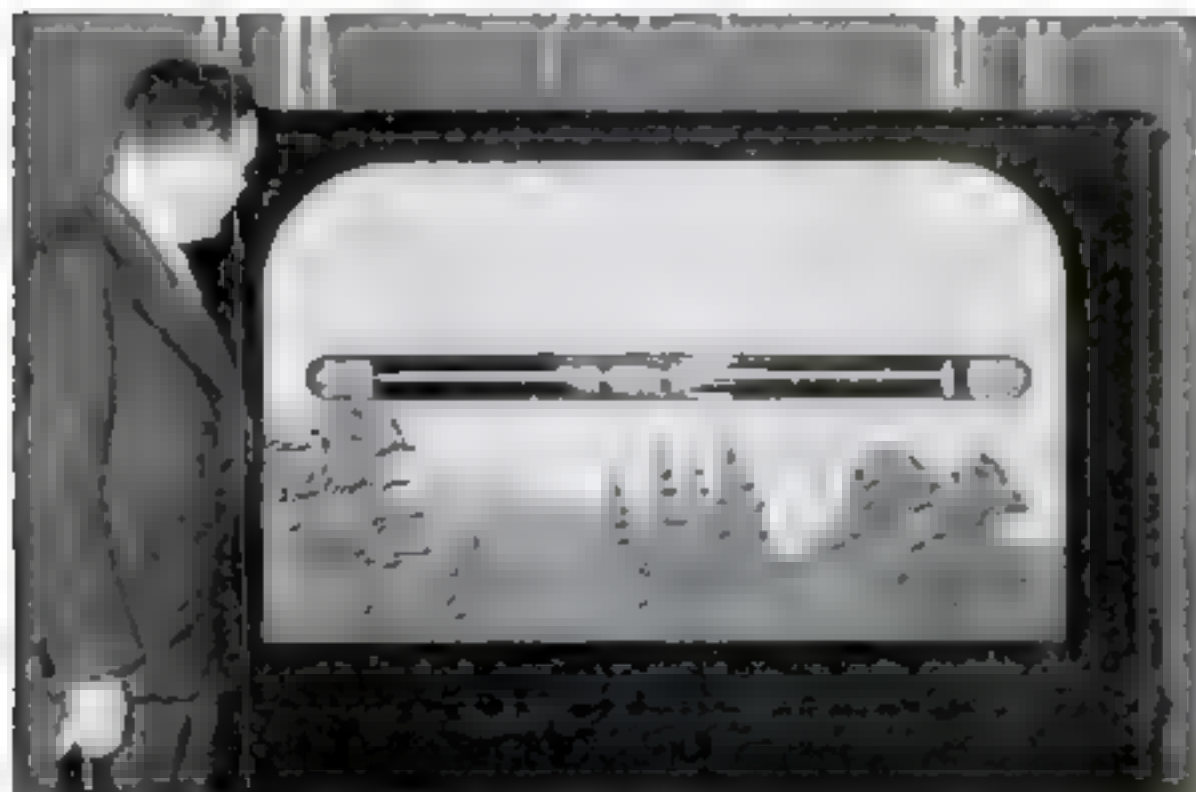
Science Matches Humans Against Rats

COMPARING the learning ability of rats and men is the purpose of new apparatus recently demonstrated at the American Museum of Natural History in New York City. The rodents averaged fifty trials before they learned to navigate a wooden maze perfectly. They had to make thirty-six right decisions in order to reach a feeding dish. Humans, tried on another apparatus in which a metal stylus slides along grooves in a block, had to make a similar number of decisions while an automatic counter recorded their errors. The average number of trials required by humans was half as many as for the rats.



Note the rat penetrating the maze at top. With a stylus, humans match their skill on the smaller maze, as in oval

Weird Aurora Shines from a Test Tube



Colored rings resembling northern lights are created by this tube

MAN-MADE northern lights recently flared in a colorful astronomy exhibit. Conditions similar to those found in the rarefied upper atmosphere, where electrical discharges resulting from sun spots produce brilliant auroras, were duplicated in a four-foot vacuum tube. A 15,000-volt current, passing through the tube, produced a purple glow that changed to pink and broke up into brilliant rings of light. As a magnet was passed along the surface of the glass tube, these rings moved, just as northern lights are seen to pass across the sky.



Edison on the Screen

FAMOUS EXPERIMENTS RE-CREATED IN MOVIE

Spencer Tracy and his leading lady studying a model of Thomas A. Edison's Menlo Park, N. J., laboratory prepared for the filming of "Edison the Man." Above is the historic scene of the birth of the incandescent lamp



HELLO! Hello! Hello! Mary had a little lamb . . . Haw! Haw! Haw!" From a thin sheet of tin foil wrapped around a revolving cylinder the words rasped out through a paper horn, much as they did in 1877 when Thomas A. Edison's first hand-cranked talking machine startled the world. This re-creation of the original "play-back" for the movie, "Edison the Man," took place on a Hollywood sound stage, where studio craftsmen, working from Patent Office models, photographs, and drawings, built a reproduction of the electrical wizard's Menlo Park, N. J., laboratory and more than 10,000 articles used or invented by Edison.

By **ANDREW R. BOONE**

Where Edison took years to make new devices workable, property men turned out a dozen of his more important inventions in a few days. Within the narrow, low-ceilinged, gas-lighted laboratory, Spencer Tracy reenacted for the camera the making of the first electric light. On other sets duplicating buildings where Edison labored, the actor showed how Edison perfected the carbon telephone transmitter considered his most important contribution to telephony; produced

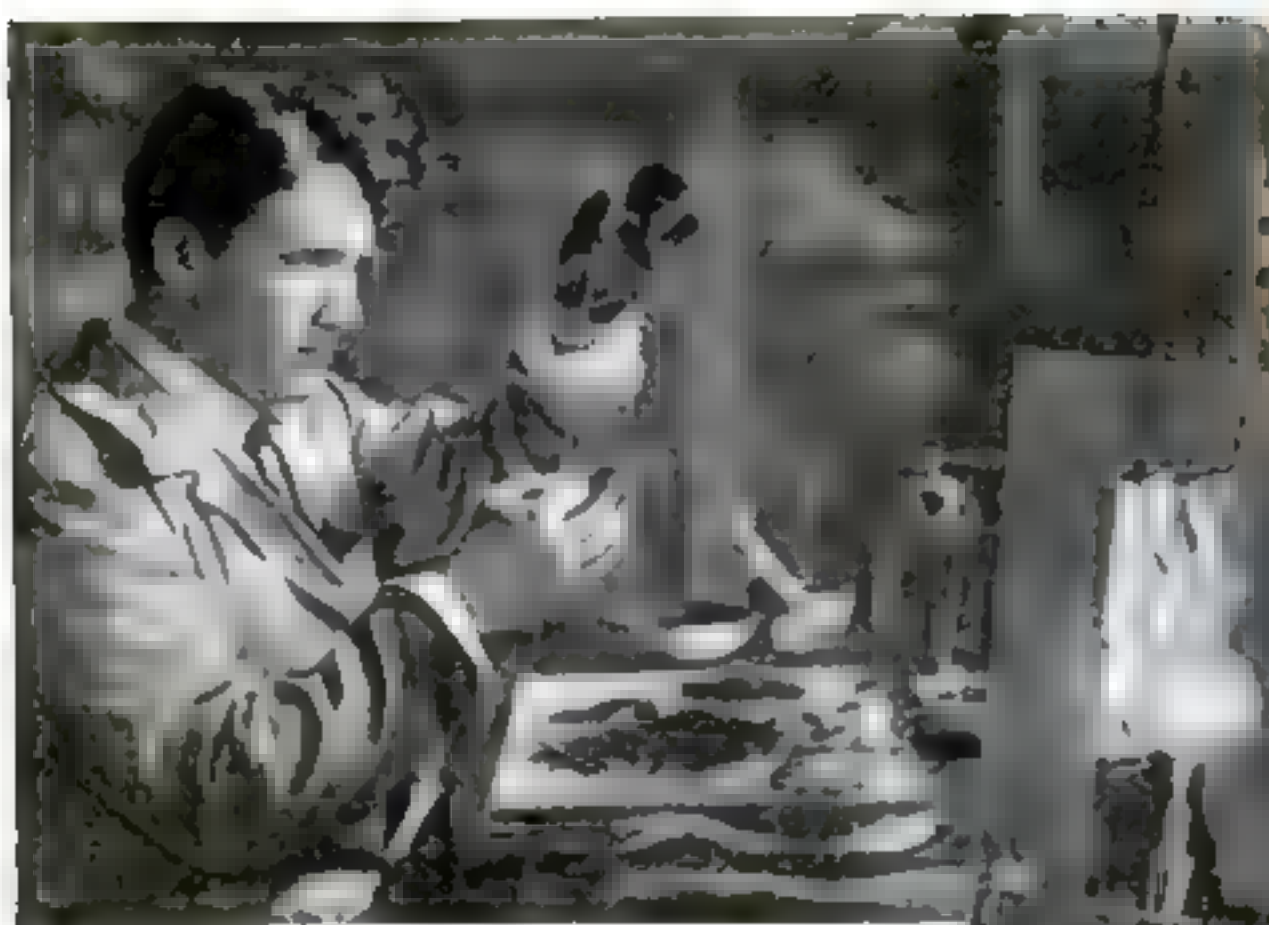


An early experiment in the development of electric lights Spencer Tracy, as Edison, watches a glowing wire spiral. At upper right, a property man is blowing a lamp bulb



Edison's first commercial generating station in New York City, as recreated for the film. Dummy dynamos whirled for weeks at the studio





Spencer Tracy shows how Edison rolled thread in lompblack for his first successful filament

the automatic telegraph repeater, and solved the problem of the carbon filament which, gleaming in a partial vacuum, gave the world better light.

Studio artists and carpenters reconstructed the laboratory, abandoned fifty-five years ago, after measuring and photographing the building as it stands today at Henry Ford's Greenfield Village in Dearborn, Mich. From



It works! The carbon-filament lamp seen in the picture below is a copy made by a studio wizard from the electrical wizard's model

twenty-nine reels of actual motion pictures covering Edison's life, including two miles of film showing all details inside the room, the building was put together with every piece of apparatus in place. For two months after the cameras started rolling, William A. Simonds, curator of Greenfield Village, sat beside Director Clarence Brown to make sure every scene was authentic.

Only in Hollywood could Edison's inventions be duplicated almost overnight. Max Goepfinger, studio property man, blew the glass and formed the bubbles into likenesses of six lamps Edison created. For the first, unsuccessful lamp, Goepfinger brazed two spirals of platinum wire into place, connecting them through other wires to several batteries on the near-by table. When the dramatic moment came for the light to fail, an electrician moved a rheostat which sent an overload of current



The original talking machine, in a studio reproduction. The words spoken into the paper horn are recorded on a sheet of tin foil wrapped around the hand-turned cylinder, and can be played back. The studio model actually works



Every detail of the famous Menlo Park laboratory, now preserved at Dearborn, Mich., was copied for this careful studio reconstruction



Edison's chalk telephone, embodying the carbon transmitter one of his great contributions in this field

surging into the filament, causing it to blossom brightly and die. It was this failure that led Edison to discover the carbon filament, consisting of a carbon-impregnated cotton thread, and to achieve high vacuum with a mercury pump borrowed from Princeton University.

Every piece of apparatus built by the movie wizards works. The automatic telegraph repeater, which hummed when turned too rapidly and led to the talking machine, actually repeated messages from one paraffin-covered disk to the other. Messages were

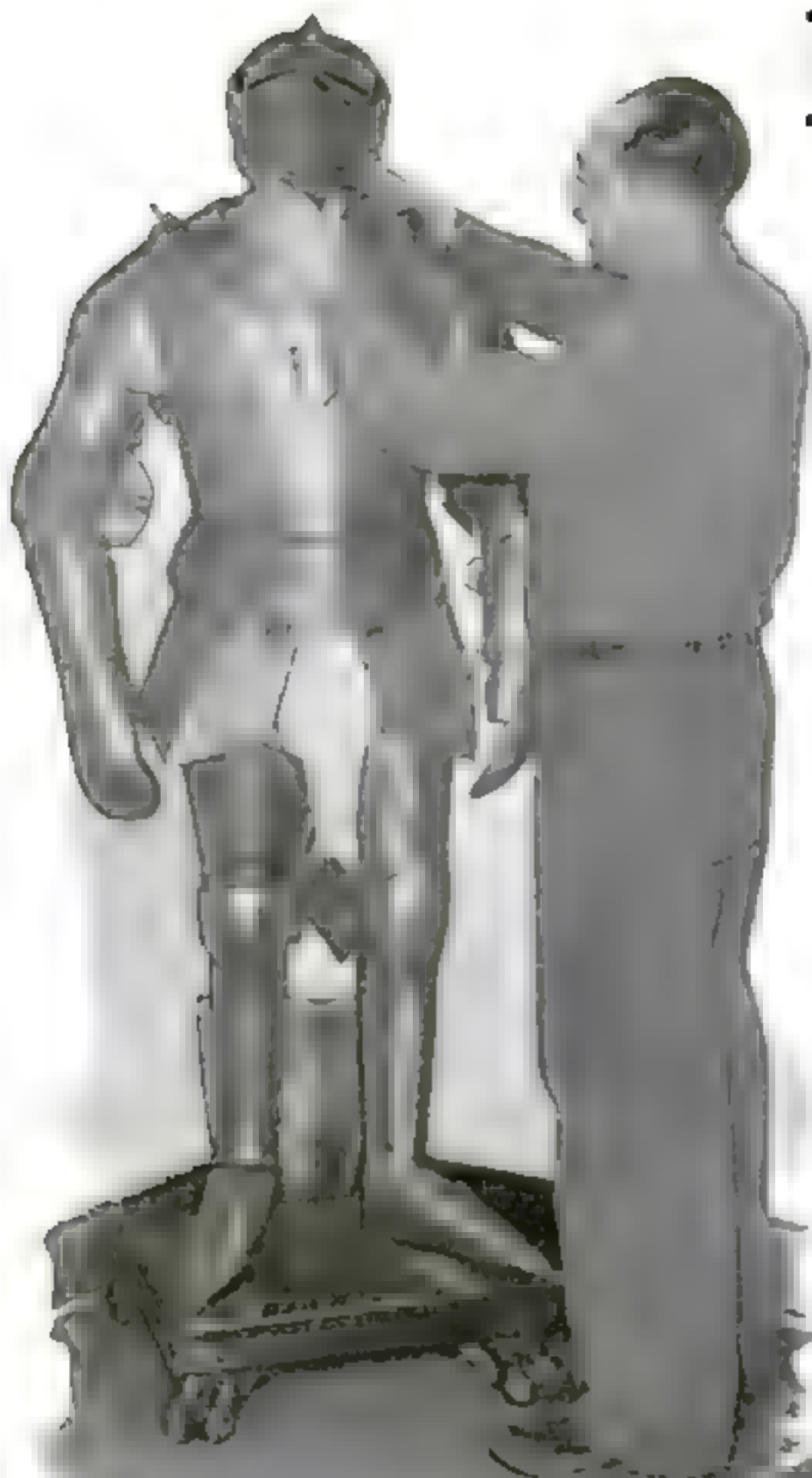
received, and heard, over the chalk telephone which embodies Edison's carbon transmitter, part of his work which made Alexander Graham Bell's telephone practical.

Only one "impractical" invention appeared on the movie stage. This was a vote recorder, which members of Congress refused to buy because knowledge of how voting was checking up would prevent filibustering, often an important political maneuver. Edison vowed then never to invent anything until he determined whether the public would accept it. Far more practical than the recorder was his first commercial central generating station, established at 255 Pearl Street, New York City.

The original, crude dynamos long since have ceased to generate power for the early electric lamps that lighted homes and business houses in that city. But their painstakingly copied duplicates, which Hollywood carpenters, electricians, and skilled mechanics labored over for weeks to produce to the last small detail from diagrams made available to them, whirled for weeks during the filming of "Edison the Man," portraying faithfully an important phase of America's gigantic electrical development.

Making Armor for Fun

BY DAY, Ralph A. Henry, of Cleveland, Ohio, works in a garage repairing dented automobile bodies and fenders. At night, in his basement workshop, he slips back a few centuries and hammers out metal parts for suits of armor like those worn by medieval knights. Becoming interested in armor at an early age, Henry adopted the subject as his hobby, and has made himself an authority on the master armor makers who plied their trade hundreds of years ago. Although he uses hand methods much like those the ancient armorers employed, he takes advantage of the help of a modern power drill and buffing machine when fashioning copies of what the well-dressed knight wore in the Middle Ages. A prize suit that Henry spent 1,500 hours of arduous, painstaking spare-time work on is modeled after a fifteenth-century suit of Spanish armor. It tips the scales at sixty-eight pounds, and has sixty-eight separate pieces of hammered sheet steel skillfully fastened together.



Ralph Henry, above, attaches a helmet to his copy of an old suit of Spanish armor

In this small basement shop he shapes the intricate steel plates. Note the finished helmet and the shield on his bench



Boys Get Free Wood for Their Hobbies



Boys "signing in" at the lumber-yard office to gather scrap wood. At the left youngsters are loading a cart at the scrap pile. Below is the permit issued boys, with map and rules

FRIDAY is "free-wood day" in Hartford, Conn., for boys with carpentering hobbies. As the result of a friendly plan adopted by a local lumber company, the boys are permitted once a week to help themselves to scrap wood piled behind the main building of the lumber yard. Early in the morning, they begin arriving, with wheelbarrows, carts, and coaster wagons in which to carry away their wood. To regulate the army of hobby riders, the company issues a combined map and permit to each boy. It indicates how to reach the scrap pile and how to keep clear of danger spots. At the bottom of the map is a set of rules which must be obeyed or the permit is taken away. Before going to the scrap pile, each boy must "sign in" at the receiving office and, when he leaves, he must "sign out." So many interesting things have been produced from the odds and ends that the company

PERMIT

RULES

is now offering prizes in a contest for the best pieces of woodwork turned out by boys getting their materials from the lumber-yard scrap pile. The free-wood plan has worked successfully since last November.

Flower Petals Yield Colors for Paintings

WITH flower-petal pigments, Ruby Warren Newby, of New York City, is producing novel and striking paintings. Her unusual hobby began years ago when she saw chil-

dren smudging petals across paper to produce streaks of color. She arranges petals and leaves on a special type of paper and squeezes out the juices with a wooden roller. Pansies, she has found, produce the most abundant colors. After trying scores of chemicals, she discovered that common milk is the best fixing bath for keeping the colors from fading. Recently, a number of her flower-color pictures were exhibited at a New York City art gallery.



Ruby Warren Newby, artist, extracting color from leaves. She sprays her finished work with milk to fix the colors permanently



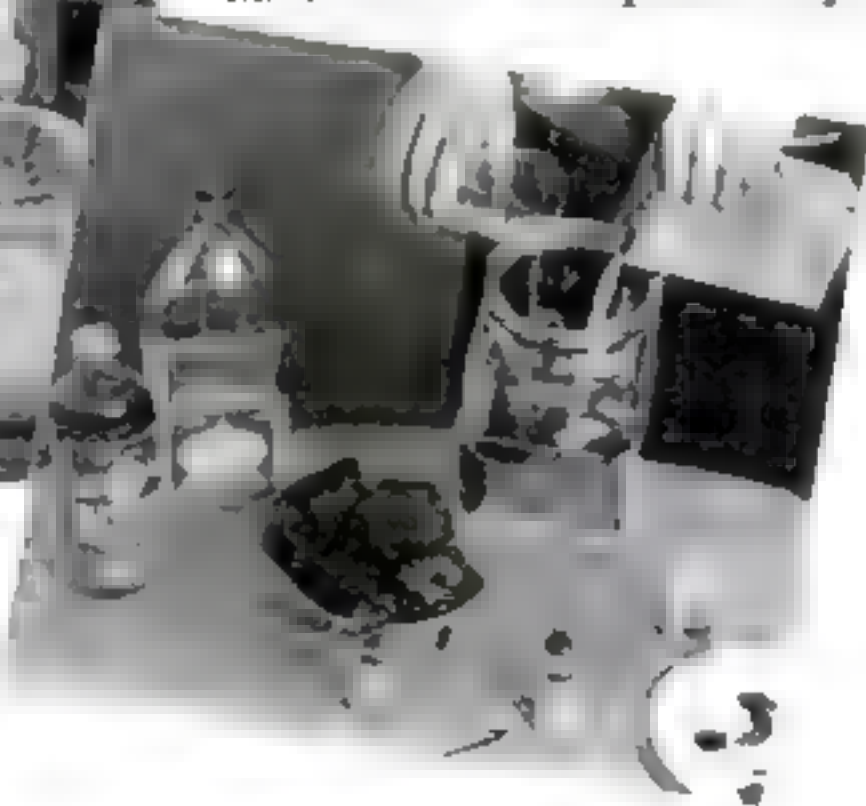
He Grows Chemical Gardens

CHEMICAL gardens, created from such common household materials as coal, water, salt, bluing, iodine, and mercurochrome, are being produced for friends and invalids as a hobby by Pat Mallor, of Elmont, N. Y. Placed in fish bowls, the lumps of coal are covered with water, and chemicals are added. Soon, crystalline precipitation begins to build up funguslike chemical deposits on the coal. Within twenty-four hours, a permanent chemical garden has been established. The brilliant hues of the deposits vary according to the chemicals added to the water.

Mallor produces striking shades of green by adding iron sulphate, bright yellows by pouring in sulphur, attractive blues by including copper sulphate. Potassium dichromate added to the water produces brilliant reds. Miniature buildings and bridges placed among the lumps of coal also become coated.



The hobbyist with some of his gardens. Common chemicals in water poured over lumps of coal produce them



Baby-Feeding Gadgets Form Odd Collection

Dr. Overton with part of his collection. At left are two old powder bottles and a feeding spoon

RANGING from crude clay cups used by the "mound builders" to the latest sanitary nursing bottle, baby-feeding gadgets collected as a hobby by Dr. D. Edward Overton, of Garden City, N.Y., record 500 years of history. Among the fifty or more items in Dr. Overton's collection are early nursing bottles with nipples of ivory, tin, whalebone, and glass. Some of the glass bottles are shaped like human heads. Others, resembling powderhorns, were produced by pioneers from cow horns by tying a piece of thin leather over the small end to form the nipple. Whale-oil wicks in the lower compartment of one "two-story" metal feeder made it possible to heat the milk contained in the upper section.



Six old-time feeders. The bottle in the foreground has a whale-bone nipple. The metal food heater above has a whale-oil wick



A group of professionals go amateur to entertain apartment tenants. Right: "Static" the house cat, meows the station's call

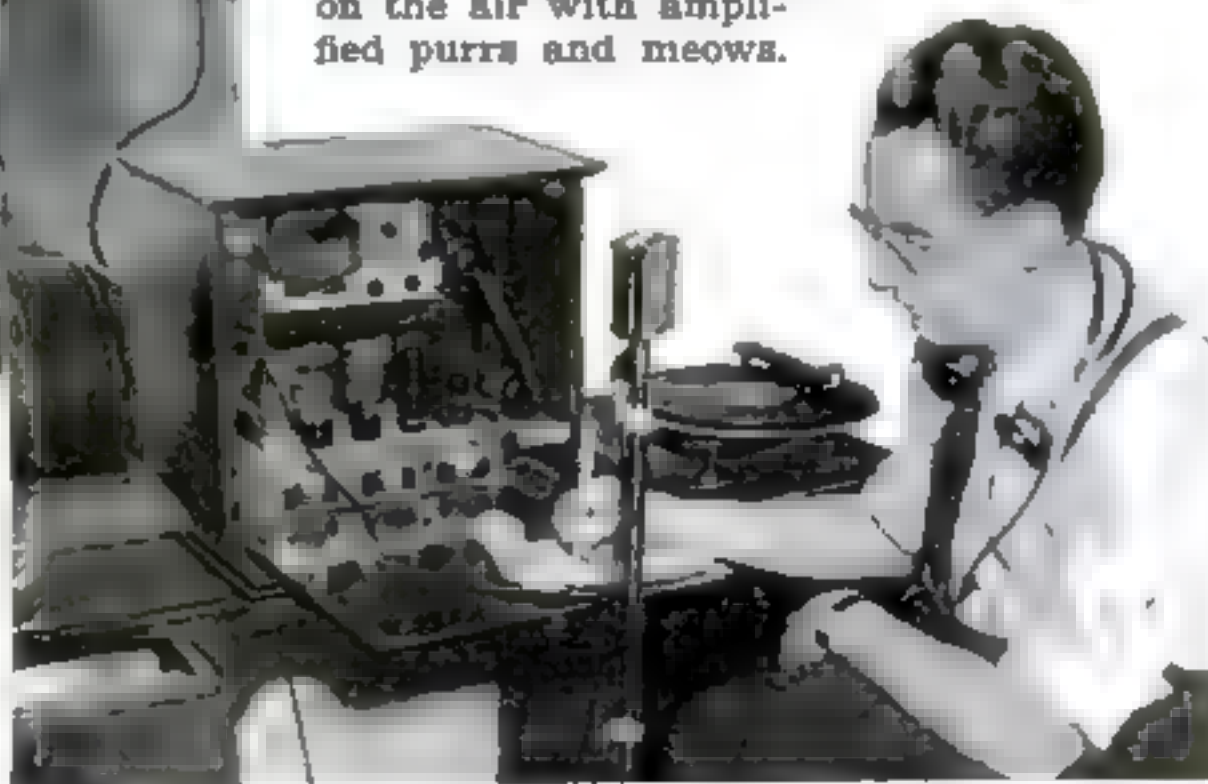


Tenants Run Apartment Network



Above is the control room occupying a second-floor closet and connected with the studio in the basement

TO ENTERTAIN friends and neighbors in a New York apartment house, a group of professional radio performers operates a unique basement "broadcasting" station. Every Friday and Sunday evening, led by Les Paul and Earnie Newton, they go on the air from their homemade soundproof studio near the furnace room. Programs go to all the apartments through a two-wire ground and aerial system which had been built into the structure and previously never used. The control room is in a closet on the second floor. Frequently, "big-name" musicians drop in to lend a hand, and guest announcers whose voices are heard regularly on nation-wide hook-ups have fun taking turns at the basement microphone. Even "Static," the apartment-house cat, occasionally goes on the air with amplified purrs and meows.



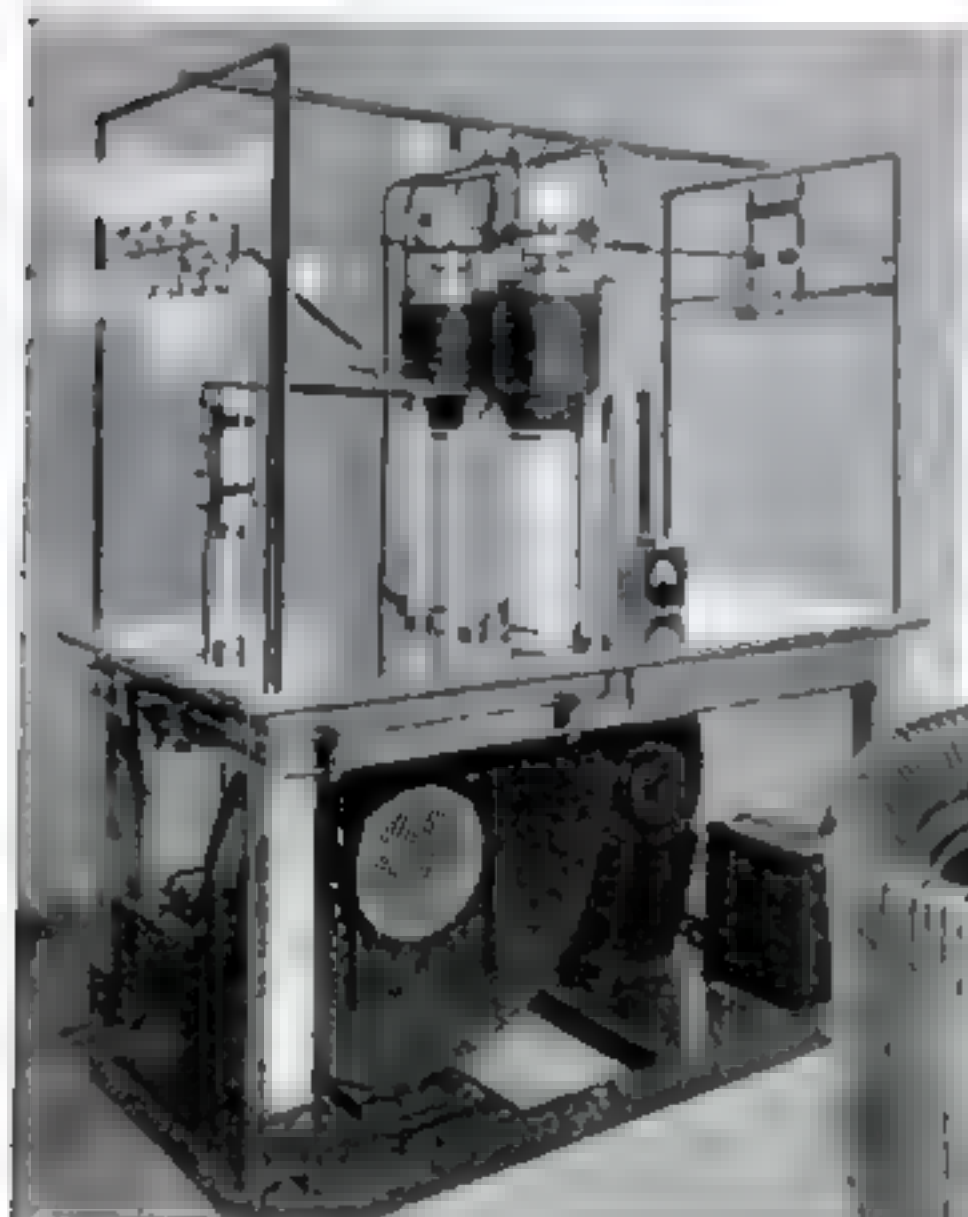
Les Paul, right, monitoring a recorded program for the listeners in the building

Midget Police Radio Fits the Vest Pocket

FITTING a vest pocket, a midget radio set designed by radio engineers especially for police use was demonstrated recently in Chicago, Ill. The tiny set is operated by batteries and employs two diminutive tubes that are dwarfed in comparison with standard sizes used in normal radio receivers. With the exception of the single headphone, which can be easily worn under the lapel, the entire circuit is housed in a compact case that measures only four inches in length, three in width, and one in thickness. The radio weighs about nine ounces. It is expected to enable plain-clothes men, patrolmen on their beats, and other roving officers to keep in contact with headquarters, making it possible for them to receive orders and make reports without loss of time.



How the tiny sets are used for sending and receiving. Right, the receiver unit beside a standard radio tube



Radial fins (right) that remove the heat

Big Transmitter Tubes Are Cooled by Air

INSTALLATION of radio transmitters employing high-power tubes, under circumstances where water cooling can not conveniently be used, is made possible by the introduction of a new type of air-cooled transmitting tube. In the set-up pictured in the photograph at the left, each of the tubes is surrounded by radial cooling fins which take up the heat given off by the tubes. Air from an electric blower mounted beneath the table supporting the tubes is forced up through the metal jackets to pass over the fins and carry away the heat.

Radio Sound Effects



Panels for walls, a board floor, and a pool table all add up to give realistic sound for a pool-room scene



For obvious reasons the sound of a sock on the jaw must be created artificially. Here's how it's done—with a cabbage head

AN INNOVATION in sound effects provides new realism for radio dramas. Heretofore, experts using standard artifices of the stage have had no difficulty in simulating such things as a knock on a door, a ringing telephone bell, or a revolver shot. But now, for the first time, they are going farther and creating appropriate "sound backgrounds" for each scene.

A man's voice takes on a different quality over a bridge table, and across a room. A woman's voice indoors and outdoors doesn't sound the same. Close your eyes in a forest, and you still hear familiar forest sounds. The same "background" would startle you in a city apartment where you might expect to hear, instead, the rumble of a surface car or subway, the sound of a radio next door, or the hum of a refrigerator.

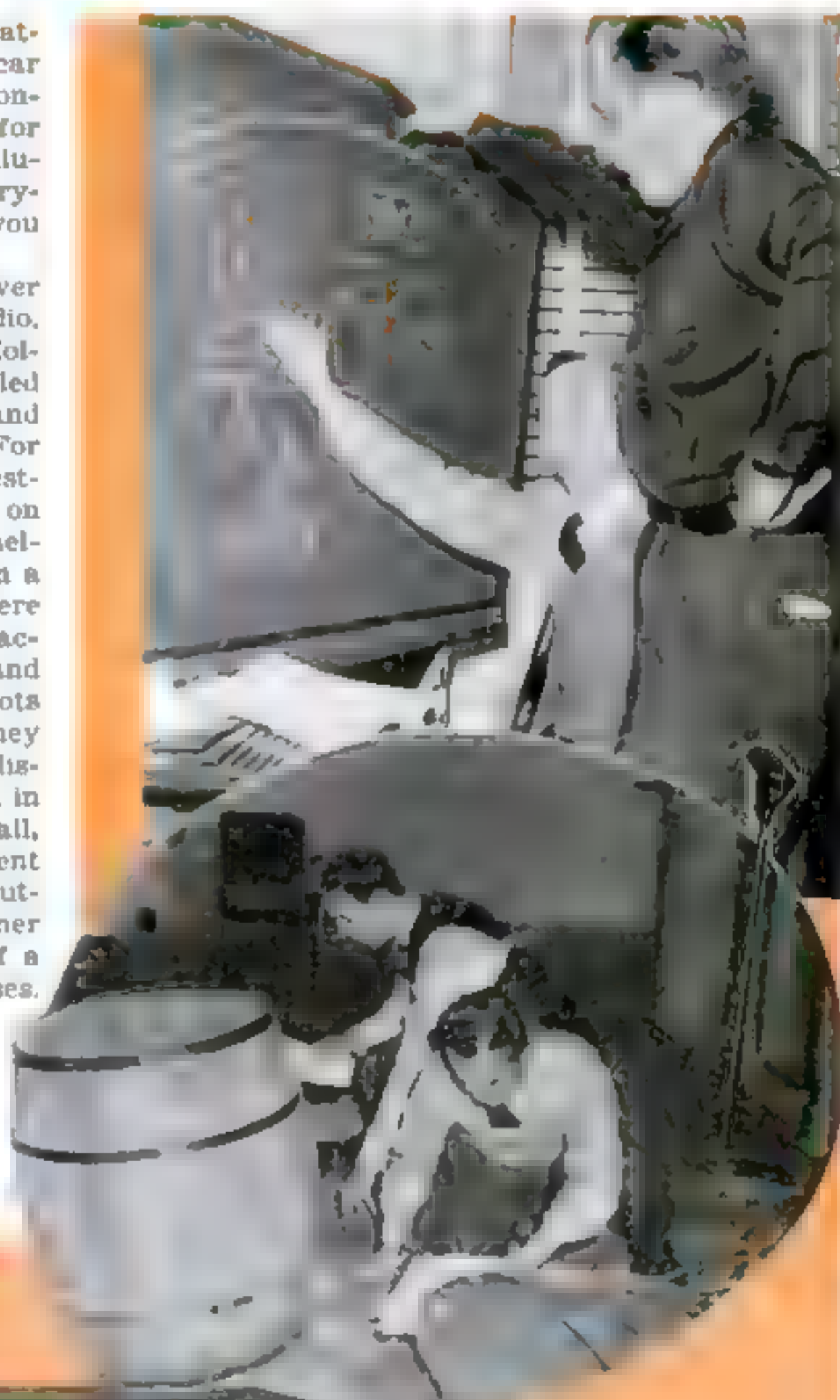
Given New Realism

In a sound movie, it doesn't matter if gangsters talking in a car sound exactly like gangsters conversing in a woodland hideout, for the picture itself supports the illusion. But in a radio drama, everything depends solely on what you hear.

Hence come stunts that have never been tried before in a radio studio. In a recent NBC experiment at Hollywood, Calif., the director wheeled an automobile into the studio and had his actors talk right in it. For a pool-room scene in a small western town, he laid wooden planks on the studio floor, built walls of paneling to give the effect of talking in a room, and set up a pool table where sound-effects men, doubling for actors, played pool with real cues and balls. Cowboy players wore boots with spurs that jingled as they walked. They spoke at some distance from the microphone except in scenes calling for close-ups. In all, the show contained 150 different sound effects, from birds singing outdoors to the creak of saddle leather for a scene in which members of a posse dismounted from their horses.

In the new technique, which is expected to spread, each "background sound effect" is carefully worked out with chalk on a blackboard, and engineers often take full advantage of as many as nine microphone outlets

Nothing sounds just like a falling body but a falling body. Below a studio man does it for the mibo



The sound-effect tricks are made simpler to follow when first plotted on a blackboard, in oval, crushing palm fronds gives sound of men walking through brush

Pedaling Peddler Sharpens Scissors



Pedaling to work, this scissors sharpener also pedals to get the work done on his belt-driven grinder

BOTH transportation and power supply for his work are furnished by the bicycle of the British scissors grinder pictured at the left. For the rear wheel of the bicycle that rolls this sharp-witted grinder from house to house in search of jobs also whirls the grinding wheels on a shaft mounted on the handlebars. A belt connects shaft and rear wheel.

Pigeon Fancier Equips His Birds for Sound

BIRDS that play music while they fly are the pride and joy of George Spiegel, Elizabeth, N. J., pigeon fancier. Spiegel attaches special lightweight reed pipes, obtained from China, to the tail feathers of his pigeons. When they fly, a musical whistling flows from their feathers.



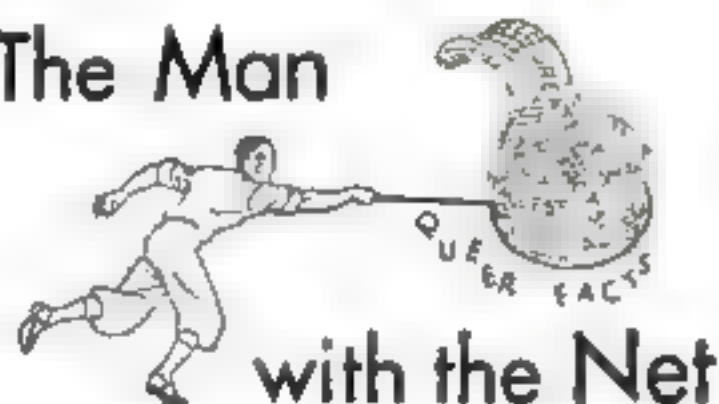
Pete the Hippo Goes to The Dentist

"OPEN wider, please," the dentist's dread command, gets a whole-hearted response when Two-Ton Pete spreads his gaping hippopotamus jaws for a periodic dental inspection at the hands of his keepers in a New York City zoo. In the photograph at the right, the examiners are wielding a dainty dental mirror, big enough for a wall decoration, to aid them in spotting defects in Pete's over-size molars.



The hippo's dental mirror makes a piker of the one your dentist uses

The Man



with the Net

ENGLISH-WALNUT shells are ground up to provide dust for insecticides.

DIRTY WATER from laundry tubs is being collected for analysis by a national laundry association.

4,000 VARIETIES of rice are grown in Japan.

CORN is a better source of oil than any other grain.

INCLUDING
TONSIL
OIL!

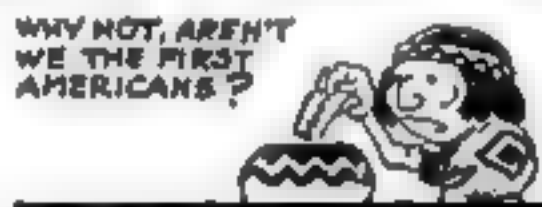


ROCKS are carried by natives of Costa Rica when crossing swift streams. The weight keeps their feet from being swept from under them.

OIL from rassa seeds, mixed with pigments for use in oil paintings, is said to cause the paint to spread rapidly on the canvas and to dry slowly.

PUEBLO INDIANS of New Mexico have been going to the polls to elect governing officials since the sixteenth century.

WHY NOT, AREN'T
WE THE FIRST
AMERICANS?



PRINTING INK in chunks like coal, to be broken up as needed, has been produced by chemists.

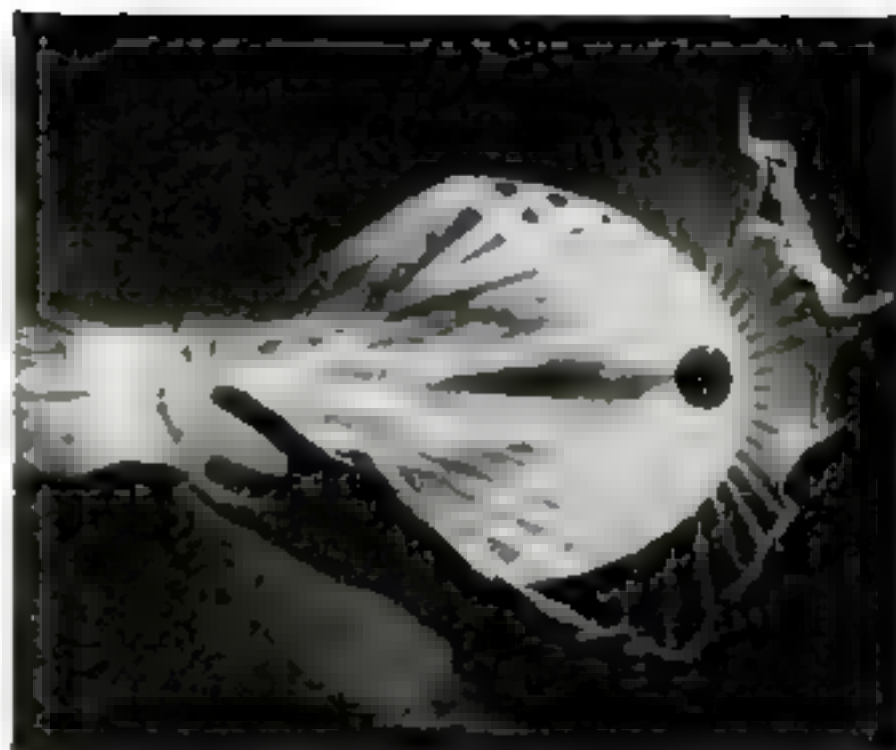
OPIUM, 300 tons of it, is being kept in the gold vaults of the U. S. Treasury, ready for emergency war use.

AIR-CONDITIONED CABINS on tractors used in moving finely ground coal at a Michigan chemical plant protect the drivers from dust.

BLUEBIRDS have all the colors of the American flag—red, white, and blue—on their bodies.



WHERE DOES
THE EAGLE GET
OFF BEING THE
NATIONAL BIRD?



Reflector Tests Produce Odd Patterns of Light

DRAMATIC lighting patterns, such as the one shown in the photograph above, were a recent by-product of research into the effect of different shapes and kinds of reflectors made by engineers at the General Electric Illuminating Laboratory, Schenectady, N. Y. An elliptical reflector, in which a sixty-watt electric lamp was supplying the light through a slotted cylinder, produced the pattern of reflected rays shown.

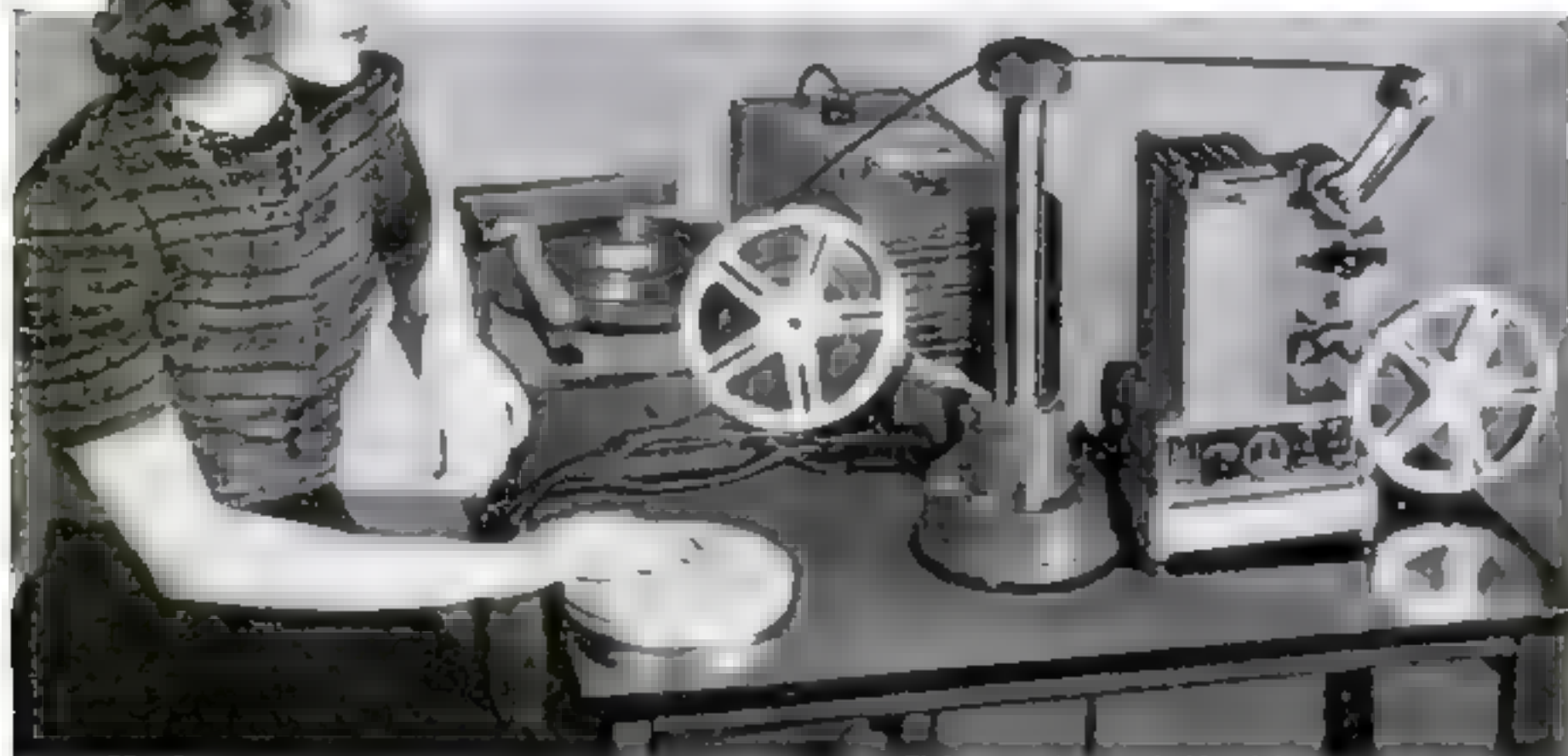
Screw Driver in Mid-Air —Magnet Holds It There

HELD in the air by magnetic forces radiating from a new 800-pound electromagnet at the Westinghouse laboratories, East Pittsburgh, Pa., a screw driver defies gravity. The powerful ball-shaped magnet was designed to sort molecules and atoms according to their weight.



A finger steadies the screw driver hanging in space

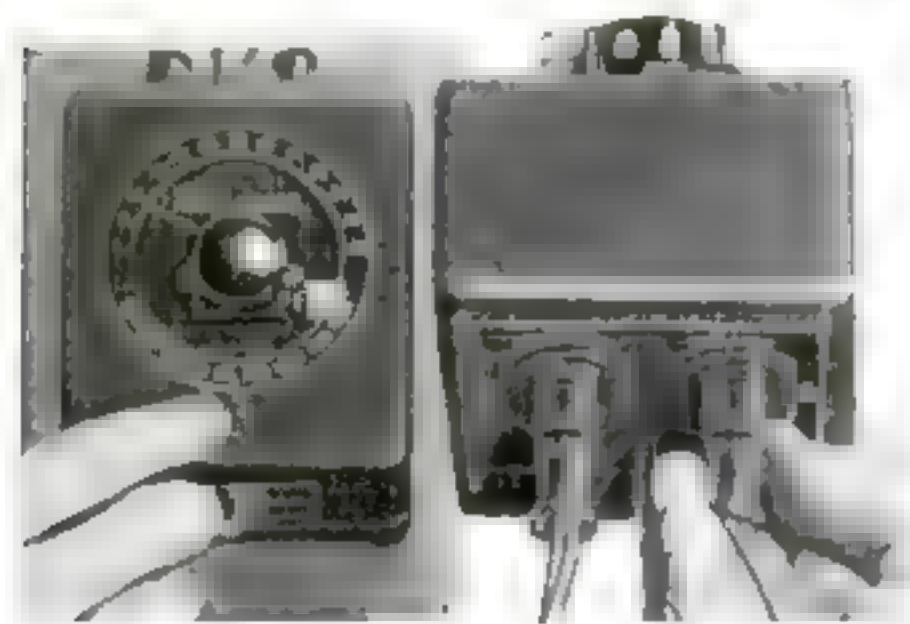
What's New in



Many-Purpose Home-Movie Sound System

SPOKEN titles and sound effects for eight and sixteen-millimeter home movies are easily made at the same time that they are synchronized to a film with the equipment shown above. It includes an electric record player on which recordings are made through a microphone. The same machine plays back the recordings through an ampli-

fier and speaker system. A special device through which home-movie film is fed during the recording process cuts notches in the film. These notches, when passing through the device during a movie showing, operate sensitive switches to reproduce the recordings as originally timed. The system is also a sensitive radio receiver.



Kit Keeps Filters Handy on Camera-Case Strap

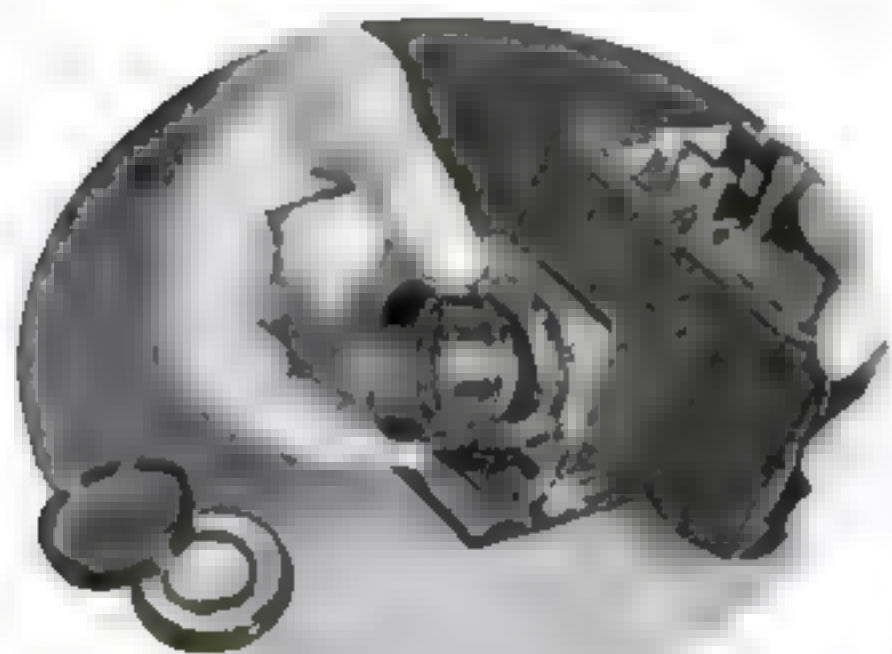
ATTACHED with snap buttons to the shoulder strap of a camera case, an auxiliary case for holding filters is now available. The filters are thus available for instant use, and the necessity of hunting through pockets for an elusive one in an emergency is done away with. An opening in the case aids in quickly selecting a filter of the desired color.

Darkroom Timer Repeats Without Any Resetting

A DARKROOM timer just introduced automatically repeats exposures for an enlarger or printer as often as its switch is pressed. Exposures between one and sixty seconds are determined by setting a dial. The unit has two electric outlets, one for an enlarger, the other for a safelight.

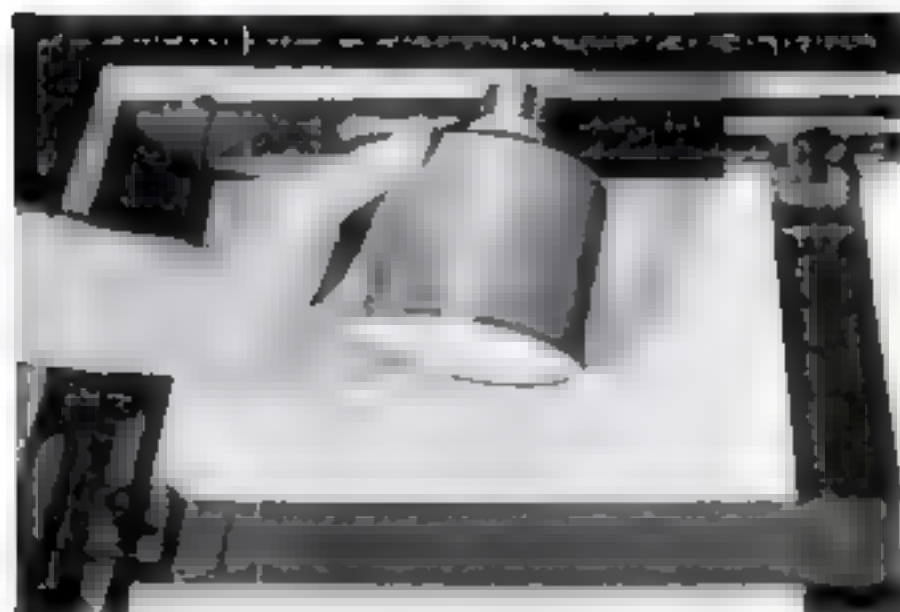


Camera Accessories



Compact Photo Accessory Serves Three Purposes

A NEW camera accessory not only serves as a filter mount, but as a sunshade and a container for carrying filters. Removing the top and bottom covers frees the center section for its sunshade and filter-holding uses.



Lamp of Cold-Light Type Designed for Enlargers

PRODUCING cold light, the new fluorescent enlarging lamp shown above measures three and three quarter inches in diameter by four inches in length, and is designed to replace the ordinary incandescent-type lamp in enlargers taking films up to three and a quarter inches square. With its own self-contained transformer, fluorescent tube, and equalizing screen, the unit is ready for instant use. It uses but fifteen watts, remains cool, and its light is said to be particularly suitable for enlarging and printing papers.

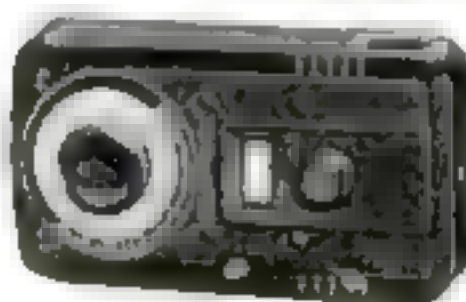
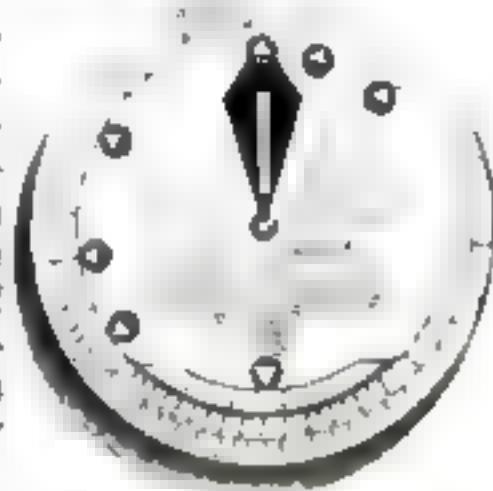
Case of Movie Camera Assures Steadier Shots

OWNERS of the new movie camera shown in use below will appreciate the feature which enables them to use the case as a steadying support against the chest.



Chart Is Aid in Titling

A WEALTH of information for photographing home-movie titles is contained on the exposure and distance chart shown at the right. It consists of two adjustable concentric metal disks marked with easily read tables.



Light Meter Is Powered by Battery

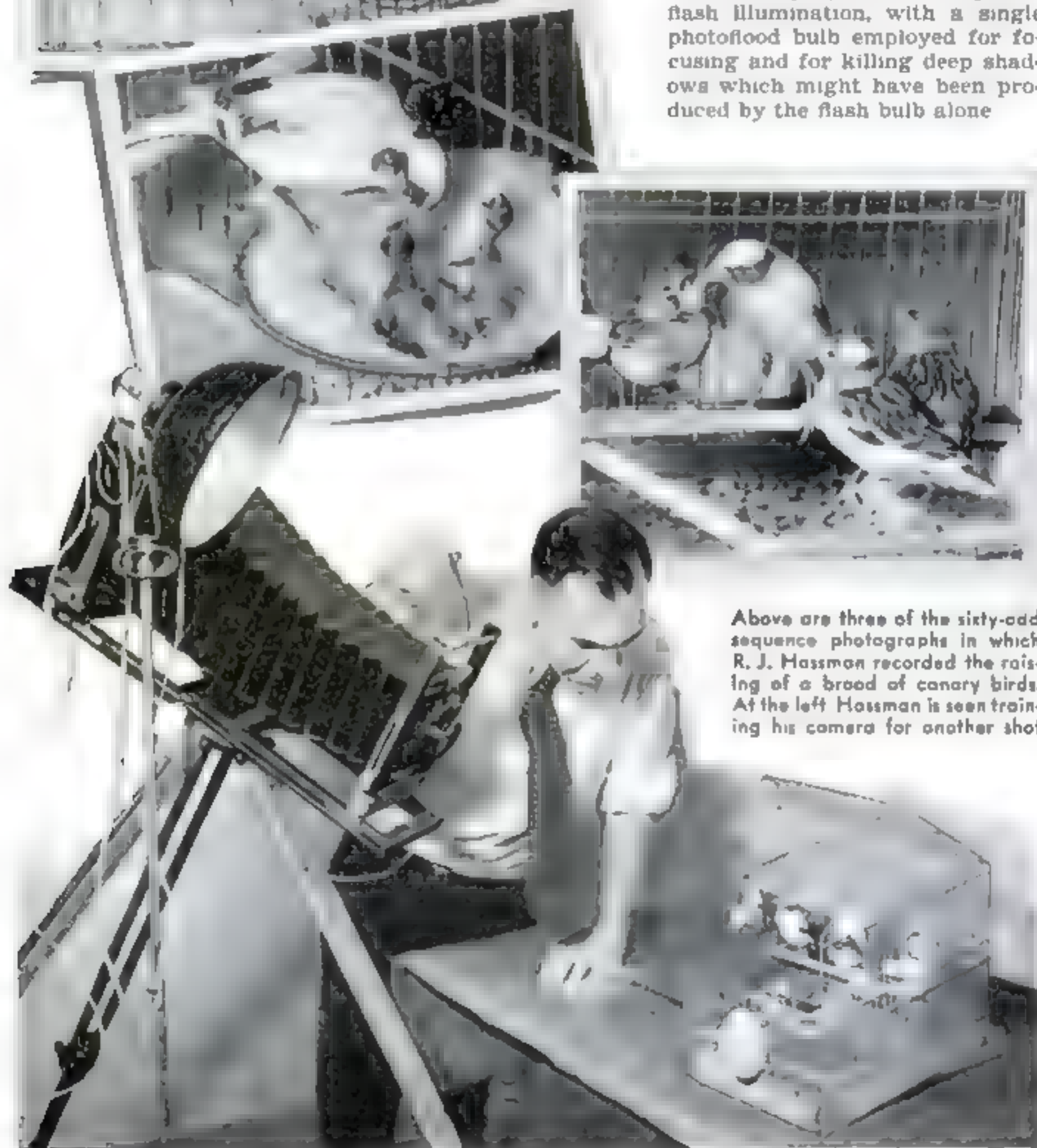
OF UNUSUAL sensitivity, a battery-powered exposure meter just marketed gives light readings of small or large scenes. Peering through a window, the user points the instrument toward a scene. Turning a dial until lines seem to match the luminosity of the scene, a reading is taken.

Camera Catches Canaries' Life Story

NIGHT and day for a month and a half, R. J. Hassman, of San Francisco, Calif., kept his camera focused on the nest of his pet canaries to record the various stages in raising a brood of young birds. By removing a section of the cage, he was able to point his camera downward and get a bird's-eye view of the birds' activity. Sometimes, Hassman had to wait as long as four hours, ready to click the shutter at any instant, in order to obtain the story-telling pose he was after. Most of the exposures were made at 1/200 of a second by synchronized photo-flash illumination, with a single photoflood bulb employed for focusing and for killing deep shadows which might have been produced by the flash bulb alone.



Above are three of the sixty-odd sequence photographs in which R. J. Hassman recorded the raising of a brood of canary birds. At the left Hassman is seen training his camera for another shot



Camera Fan Lays Trap for Thief

SET a camera to catch a thief. That is the revised version of the old proverb which Joseph Marques, of Plymouth, Mass., used to trap a "phantom burglar" who had eluded police in fifteen robberies. An amateur photographer employed by a local theater, Marques rigged up a homemade camera trap and placed it in the office of the theater. As soon as the burglar forced a window and vaulted into the room, the mechanical sleuth went into action. In quick succession, a buzzer sounded, causing the thief to look in the direction of the camera; a magnet flipped open the shutter; and a relay set off photoflash bulbs. A bell frightened the intruder away before he could locate the camera. So clear was the resulting photograph that, within a few hours, the police announced the capture of the burglar.



Ingenious camera trap devised by Joseph Marques to catch a "phantom burglar." Above is the photograph it snapped as the intruder entered



The compact machine in background records book loans on film

Photography Cuts Cost of Keeping Library Records

PHOTOGRAPHY has cut the cost of handling books at the Gary, Ind., public library to less than one sixteenth the former figure. When a book is taken out, the librarian slips three cards—one identifying the borrower, another the book, and a third giving the date when the volume is due—into a machine. A flip of a switch photographs the cards on sixteen-millimeter film. About 6,500 books can be recorded on 100 feet of film, it is said.

For Good

If I were sailing for Australia's fishing grounds, starting an extended hunting trip, driving across the continent, or simply motoring into the country for the week-end, I would carry only one camera, one type of film . . . and four filters.

So equipped, I would be ready to take good pictures under virtually all conditions of topography and natural lighting.

Until you shoot pictures through filters, your camera has not begun to return the dividends of pleasure you have a right to expect from it. Filters are not mysterious attachments intended to make picture taking more difficult, provided you follow my plan. Nor are they expensive. Four filters costing about eight dollars will open new glories of sunrise and sunset, new dramatic thrills in clouds, hidden beauties of woods, streams, and camp.

Whenever I pack my duffel for a trip, I automatically load my camera with a moderate-speed panchromatic film, and slip an Aero No. 1 filter over the lens. Today, I take the majority of my pic-

Dramatic photos are made with a 23A filter, or a Wratten G as in example above

Taken one after the other, these photos show how a K2 etches in the clouds

Photos *Use Filters*

tures through this filter; and when I remove it, I put in its place a K2, a 23A, or a Wratten G. These constitute my quartet of all-purpose filters.

One purpose of a filter is to hold back certain colors of the spectrum in order to contrast some masses of picture material with others which, in the absence of a filter, would appear as a monotone on the negative and print. Thus, a filter serves to increase the contrast between various elements, as cloud and sky, and to preserve the texture in the skin, or the color in the eye and lips. But let's keep the problem simple and avoid confusion. Let's stick to those four filters.

Suppose we consider the spectrum. At one end you find the shorter, ultra-violet rays; at the other, infra-red long rays, to which, although they are invisible to the eye, photographic emulsion is sensitive. When the short ultra-violet rays strike haze in the air, the haze lights up producing a diffusion which clouds the film, preventing reds and other colors from recording.

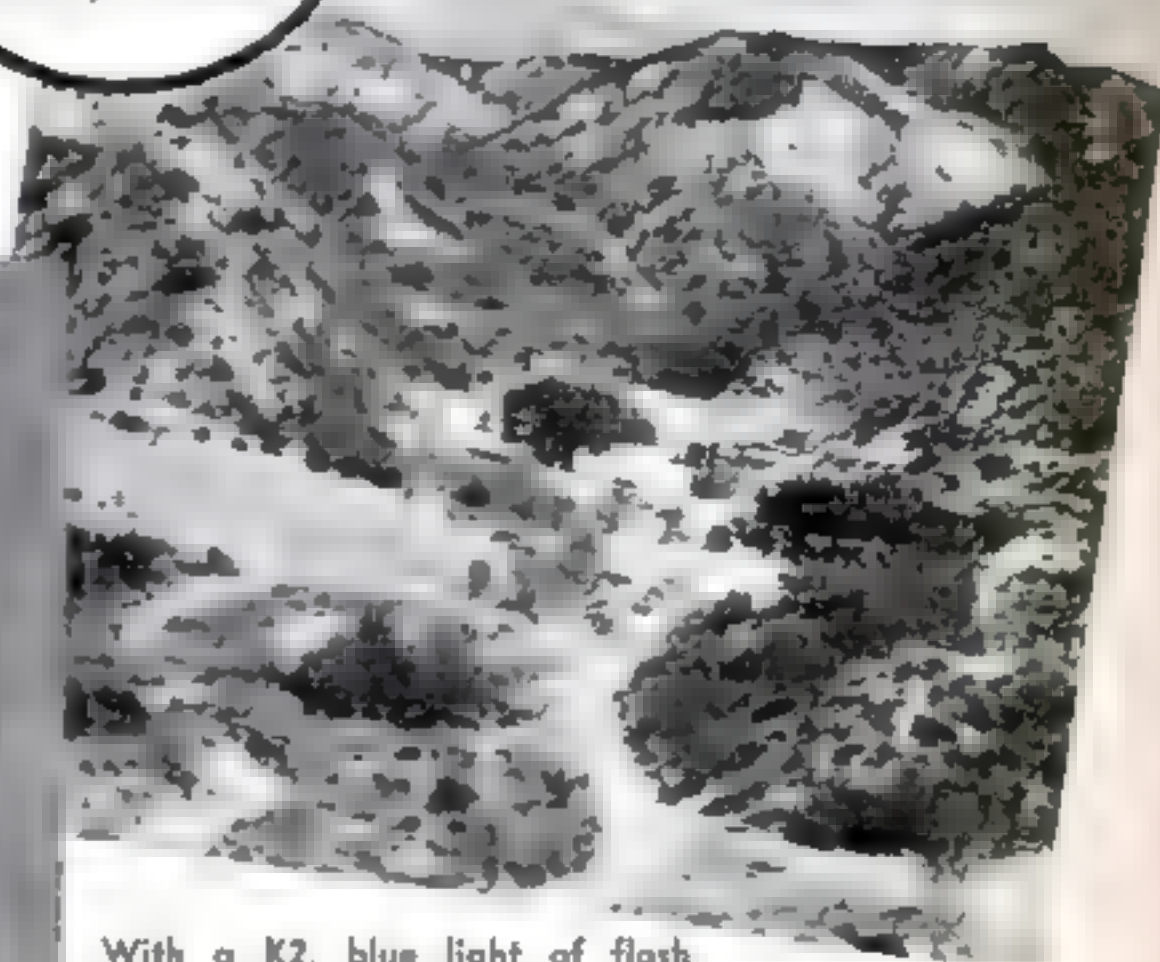
To overcome this condition, I use an Aero No. 1, a pale yellow filter designed to pass all colors other than the violets, letting them register as though there were no haze to hinder their flight through space.

Continued on page 122

By **WILL N. FOX**



Note, too, what the K2 does to scenes showing water, sky, and clouds. It darkens water and does not misrepresent the sky as black.



With a K2, blue light of flash bulb renders skin texture wet. Aero No. 1 penetrates hazy air.



You Can Raise FLOWERS



The ferns and other plants above were grown in sand by a novel method worked out for flower fanciers by a California horticulturist

A LIVING-ROOM GARDEN

Is possible now with packaged chemicals an eye dropper, a few of the pots shown at the right, some clean sand, and water. The arrow points to the claylike wick that is the heart of the system

RAISING flowers indoors without soil is made practical for amateur gardeners by the recent introduction of a flowerpot specially designed to feed plants chemically. Seeds, cuttings, bulbs, small seedlings, or even fully matured plants can be placed in sand in the top half of the two-piece pot. In the lower half, a small quantity of a special chemical plant food is added to a supply of water. The divided pot is then made into one by placing the sand-filled section on top of the liquid-food container. A narrow claylike wick joins the two halves and by capillary action draws up just enough of the balanced chemical solution to feed the sand-planted seeds. The pots are made



WITHOUT SOIL

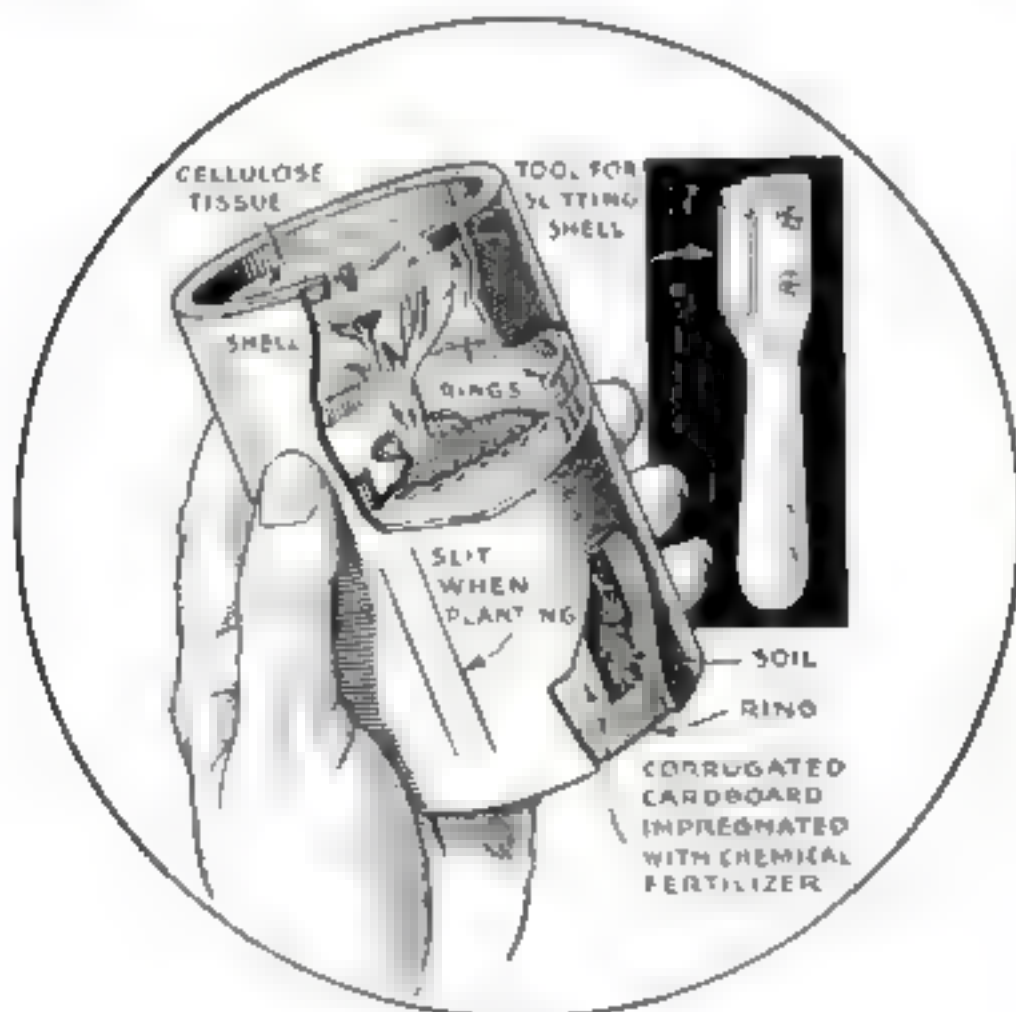
in the form of urns, vases, oblong window boxes, and tanks, as well as in the conventional flowerpot shape. A fresh supply of the chemical food is added at periods ranging from one week to a month, depending on the size of the plant.

This system of floriculture was worked out as the result of extensive experiments made by Ernest W. Brundin, of Montebello, Calif. Brundin demonstrated several years ago that field plants could be grown commercially in shallow tanks of chemically treated water according to methods developed by Dr. W. F. Gericke at the University of California. But he realized that amateur gardeners could not be expected to keep the chemical plant-food solution in the exact balance necessary for healthy plant life, so he evolved the wick system described above, which automatically supplies a balanced chemical diet to seeds placed in inert sand. At Brundin's experimental chemical gardens in California, he grows not only English ivy, African violets, and begonias, but useful kitchen herbs as well.



A decorative flowerpot. The lower half holds water and special chemicals, the upper the plant in a bed of sand

Living Plants Are Now Put Up in Packages



Supplied with an opener, the novel container holds earth, fertilizer, and plant

LIVING plants, in packaged form, for home gardeners are a novelty planned by Clarence E. Wilson, of Manchester, Conn. A small flowering plant, its roots incased in a ball of earth, is placed in a cylindrical treated-cardboard package. Within the container, surrounding the earth ball, is a corrugated lining impregnated with chemical fertilizer. A specially designed transparent top is fitted on, forming a miniature greenhouse, admitting light, and allowing buyers to see the plant. To place the plant in the garden, the buyer simply slices off the greenhouse top of the package with a special cutter provided and opens slots in its sides for the admission of moisture. The cardboard shell is then immersed in water for a few minutes and finally placed in the ground, where the outer container disintegrates, allowing the plant roots to spread and grow.

Conveniences for the



GAS-RANGE BARBECUE

Whole chickens, hams, and roasts can be barbecued in a special compartment of a gas range just introduced

CLOSET SHOE RACK. As many as ten pairs of shoes can be put in the closet rack shown below. Vertical wooden strips support shoe trees on adjustable brackets



MAGNETIC PIN TRAY

Pins, hairpins, and other metallic objects are held on the mother-of-pearl tray at left by a magnet set in the base

PARTITIONS FOR DRAWERS

Drawers can be divided into compartments of various sizes by the cardboard sections below



PEDAL OPENS GARBAGE BAG

Held in a folding frame, a moisture-proof paper garbage receptacle opens when a lever is pressed with a foot. When full, the container is detached from the frame and a new one put in



PINLESS CLOTHESLINE

No clothespins are required with a nine-foot clothesline designed for indoor or travel use. Twenty-four beads on the double line are slid together in pairs to grip the clothes as seen at the right

CLEANING CABINET

Many steps can be saved by keeping the articles needed for household cleaning in a portable rack shown below



STRAINER IS ADJUSTABLE

Slotted disks fit the bottom of this novel strainer. By placing a pair with the slots parallel or at any desired angle, the fineness of the strainer mesh can be varied

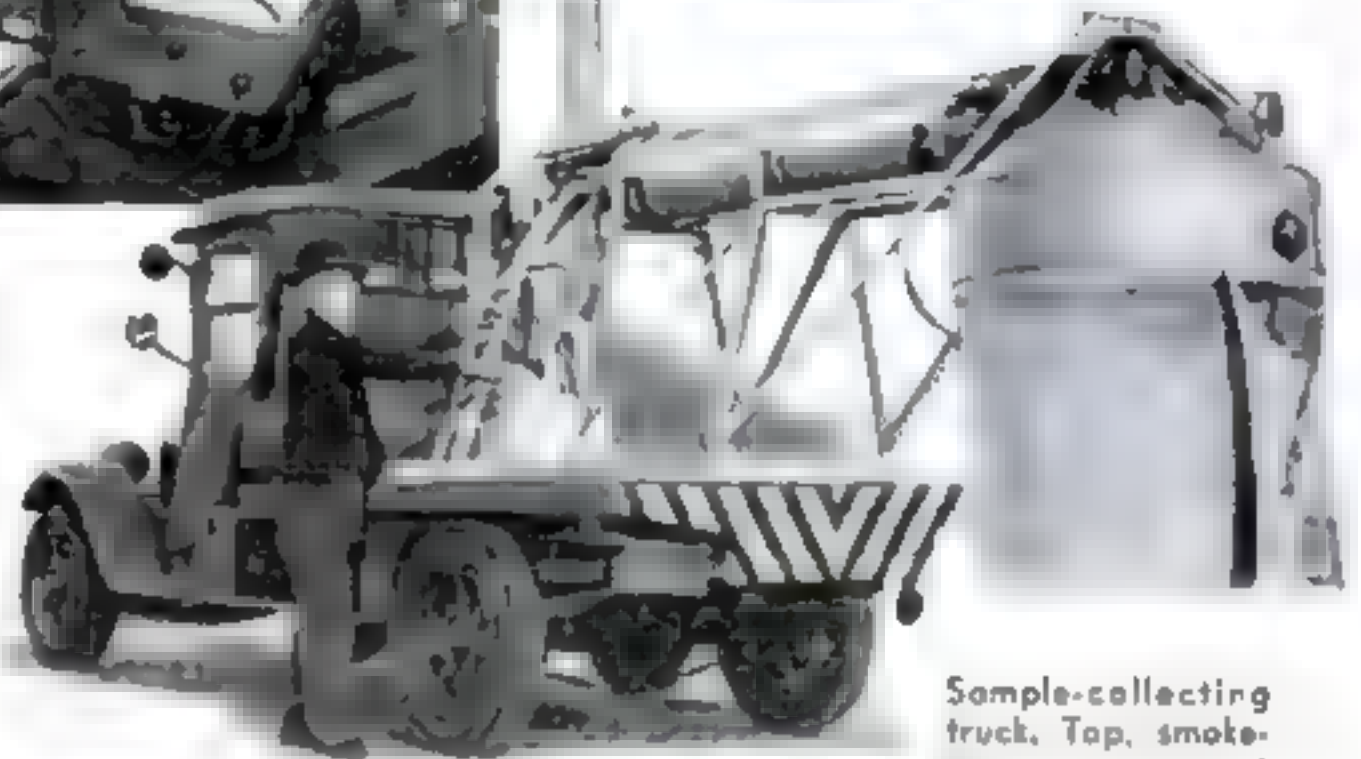
CARD-PLAYING KIT. In each arm of the miniature chair at the left is a deck of playing cards. The back holds a supply of score pads, and the seat two ash trays

Sniffer Samples Smudge Smoke



This light-reflecting meter tells in a jiffy how much soot has been collected on the felt sample pad

A MECHANICAL sniffer that samples the smoke issuing from smudge-pot heaters maintained in citrus groves to combat frost, is a recent invention of University of California agricultural engineers that is now being used by agents of the Los Angeles sheriff's office, in an anti-smudge campaign. Mounted on a truck and operated by a one-horsepower motor, a pump sucks smoke up through an asbestos hood placed over the orchard heater. Part of the smoke is by-passed through a piece of felt that absorbs the carbon particles present in



Sample-collecting truck. Top, smokeless smudge pot

the fumes. Taken to a laboratory, the felt filter then is tested in a light-reflecting meter to determine just how much carbon is being blown into the air by the heater. These tests are part of a campaign to eliminate the heavy pall of smudge that overhangs California citrus groves when smudge-pot heaters are in operation.

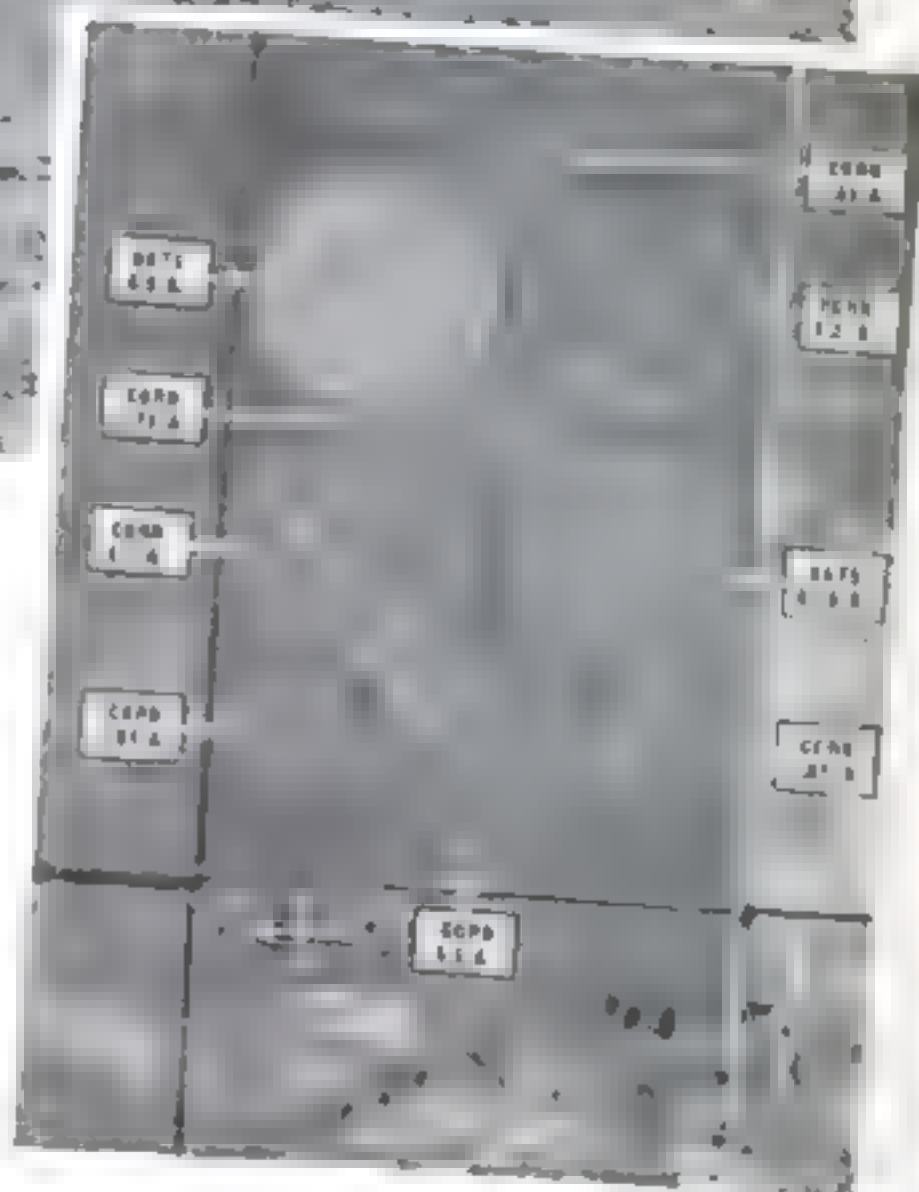
Basting Machine Is Dressmaking Aid

DRESSMAKERS should welcome a handy sewing device that takes over much of the tedious basting work required when making clothes from paper patterns. By merely wheeling the threading tool along over the pattern, as pictured at the right, a basting thread is sewn, joining the pattern and the fabric underneath to facilitate the cutting of the cloth.



SCIENTISTS at the University of California recently announced the development of a substitute for egg whites, which should cut down the cost of food dishes in which the expensive whites are a necessary ingredient. The substitute, light yellow in color, is extracted from flour made from soy beans, and is diluted with water before being whipped for use. In kitchen tests of the new material with various recipes that call for egg white, solutions containing ten to fifteen percent of the extract were successfully substituted in making meringues and soufflés, while five-percent solutions served for cold whips, toppings, and frozen desserts.

TRACTOR-DRAWN plows, harrows, and other implements do their work with little or no attention from Frank Andrew, the owner of a Paimyra, Ill., farm who has devised an ingenious automatic cultivating system. A special steering control on the tractor is attached by a cable to a horizontal drum supported in the center of a circular field. Once started, the tractor moves in an ever-diminishing circle as the cable winds up on the drum. The plan at the right shows circular plantings of oats and corn. Soy beans are sown between the circular fields.



POPULAR SCIENCE

Question Bee

Try these posers on your friends when you get through with them yourself. If you get all but four correct, you're doing all right. To figure the score, turn to the answers on page 217



1 Castor oil comes from (a) a deep-sea fish (b) beanlike plant seeds (c) petroleum refineries (d) the sap of a jungle vine.

2 A British thermal unit is defined as the amount of heat required to (a) fry an egg (b) melt an ounce of pure lead (c) raise the temperature of a pound of water one degree F.

3 Once people did their writing on papyrus, which was made from (a) the fruit of papaya trees (b) various kinds of animal skins (c) the pith of an Egyptian reed.

4 Helium was first discovered in (a) copper mines (b) the sun (c) sea water.

5 A farmer would be amused if you didn't know that plows were equipped with (a) springboards (b) moldboards (c) washboards (d) drawing boards (e) running boards.

6 The simplest form of electrical condenser consists of a pair of conducting surfaces, separated by (a) a dissimilar metal (b) an insulator (c) a voltage divider.

7 A common name for brimstone is (a) pumice (b) fool's gold (c) quartz (d) sulphur (e) coke.

8 The diamond surpasses all other known substances in (a) costliness (b) hardness (c) specific gravity (d) malleability.

9 Deer meat goes by the name of (a) beef (b) pork (c) veal (d) mutton (e) venison (f) Bologna.

10 A measuring instrument whose scale has been marked, or corrected, by comparison with a standard of known reliability is said to have been (a) decimated (b) calibrated (c) arbitrated (d) palliated.

11 Various kinds of bacteria are shaped like rods, globes, and (a) cubes (b) rings (c) corkscrews (d) stars.

12 Doubling the diameter of a water pipe (a) doubles its capacity (b) quadruples its capacity (c) increases its capacity approximately 3.1416 times.

13 When no more of a substance will dissolve in a given quantity of liquid, the solution is said to be (a) saturated (b) ionized (c) precipitated (d) colloidal

14 Nitrous oxide is popularly known as (a) sweet spirits of niter (b) laughing gas (c) German silver (d) Chile saltpeter.

15 If a meteorite falls on your property, it belongs to (a) you (b) the nearest astronomical observatory (c) the National Government.

16 You would use an electrophorus to (a) magnetize a piece of steel (b) find the resistance of an electrical circuit (c) experiment with static electricity.

17 Ice (a) is always at thirty-two degrees F. (b) may have a much lower temperature than the freezing point (c) usually is colder than "dry ice," or solidified carbon dioxide.

18 If a number of lamp bulbs are connected in series, and one of them burns out, all the rest will (a) get brighter (b) get dimmer (c) go out.

19 A knot in a board indicates a place in the original tree trunk where (a) a limb once branched off (b) the growing tree filled in a hole made by a woodpecker (c) sap flowed through a natural pipe.

20 Early radio sets employed devices called (a) mare's-tails (b) crow's-feet (c) bullseyes (d) cat whiskers.

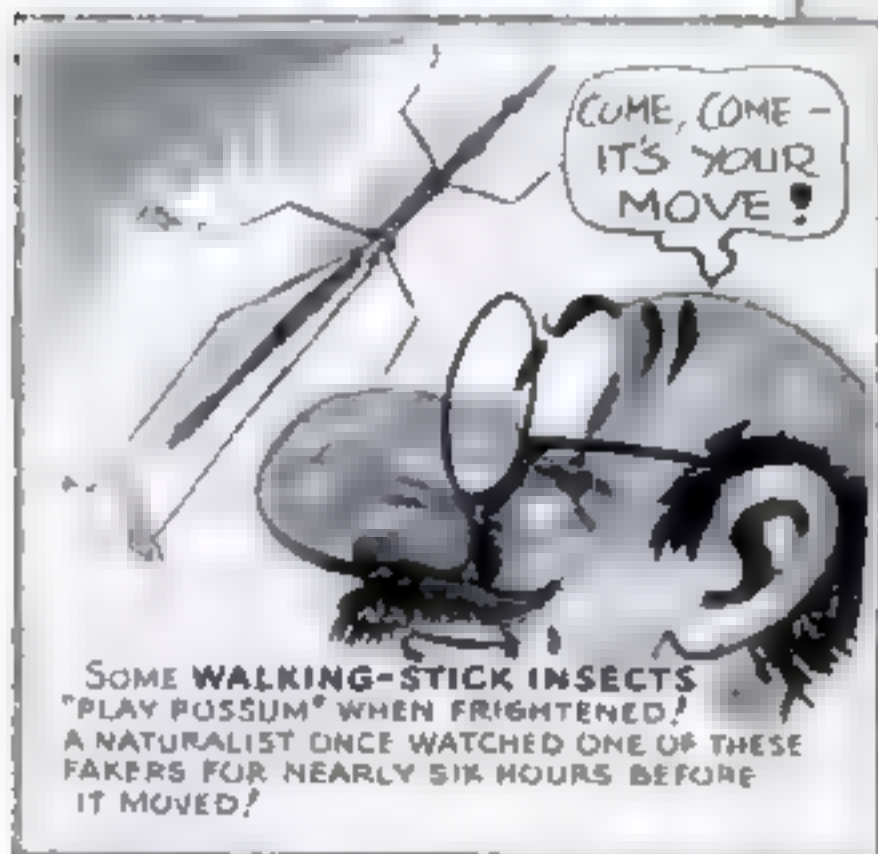
Un-Natural History

By
Gus Mager

LIKE THE KANGAROO, THE TASMANIAN WOLF CARRIES ITS YOUNG IN A POUCH! BUT SINCE THIS ODD MARSUPIAL WALKS ON ALL FOURS, THE POUCH OPENS TOWARD THE REAR!



PET CRICKETS SERVE AS WATCHDOGS IN THE ORIENT! WHEN AN INTRUDER APPEARS, THE INSECTS STOP THEIR CHIRPING, AND THE UNACCUSTOMED SILENCE AWAKENS THE OWNER!

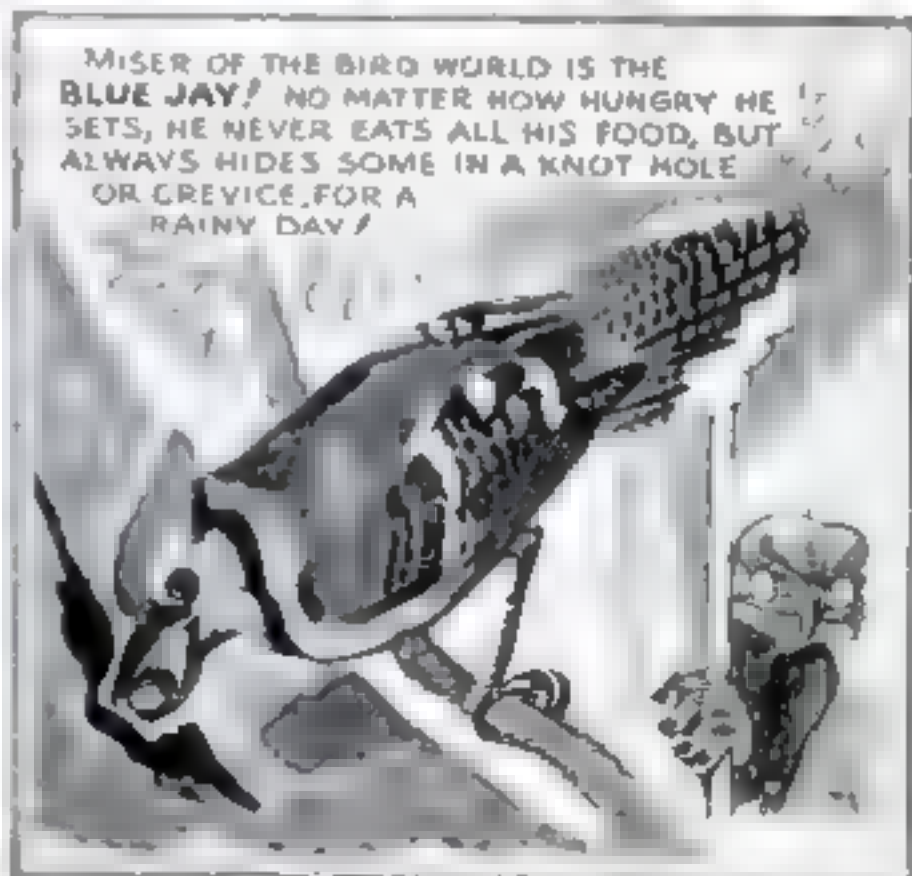


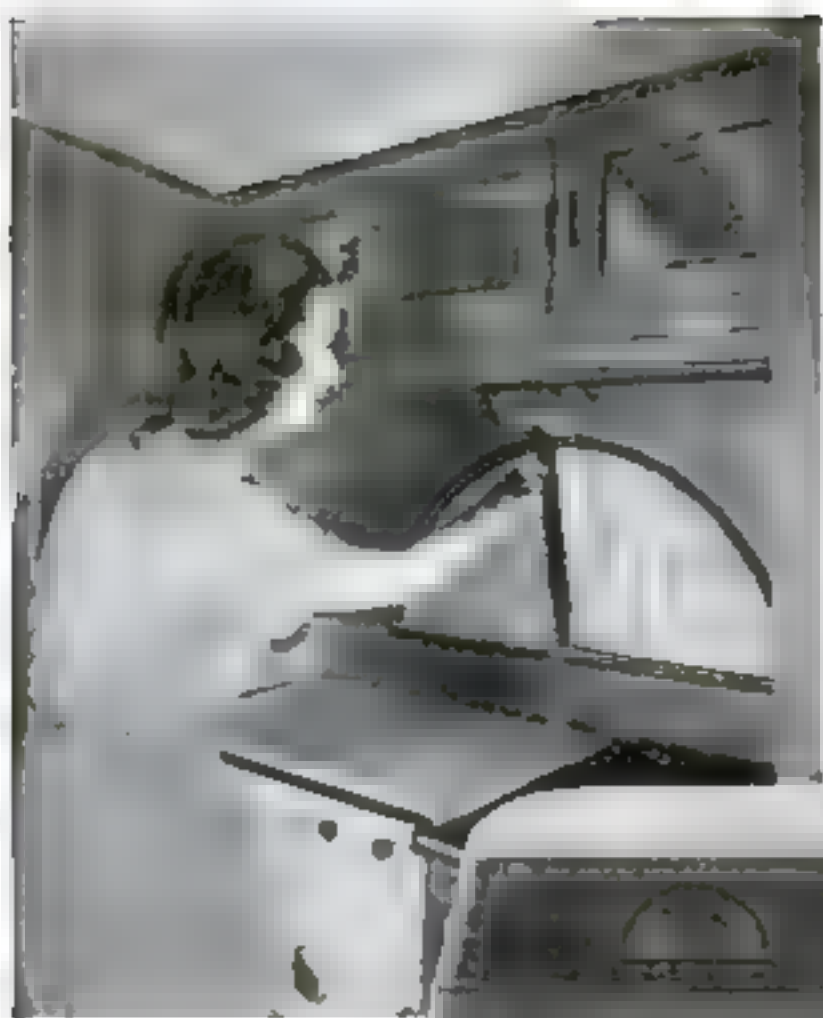
SOME WALKING-STICK INSECTS "PLAY POSSUM" WHEN FRIGHTENED! A NATURALIST ONCE WATCHED ONE OF THESE FAKERS FOR NEARLY SIX HOURS BEFORE IT MOVED!

THE CATFISH OF THE DANUBE RIVER GROWS TEN FEET LONG! IN COMPARISON, OUR MISSISSIPPI CAT IS ONLY A MINNOW!



ALASKAN BLACKFISH, KEPT FROZEN IN THE WINTER AS DOG FOOD, HAVE BEEN KNOWN TO THAW OUT AFTER BEING SWALLOWED WHOLE, AND TO BE DISGORGED ALIVE SO THAT THEY SWAM AWAY UNHARMED! JONAH IN REVERSE!

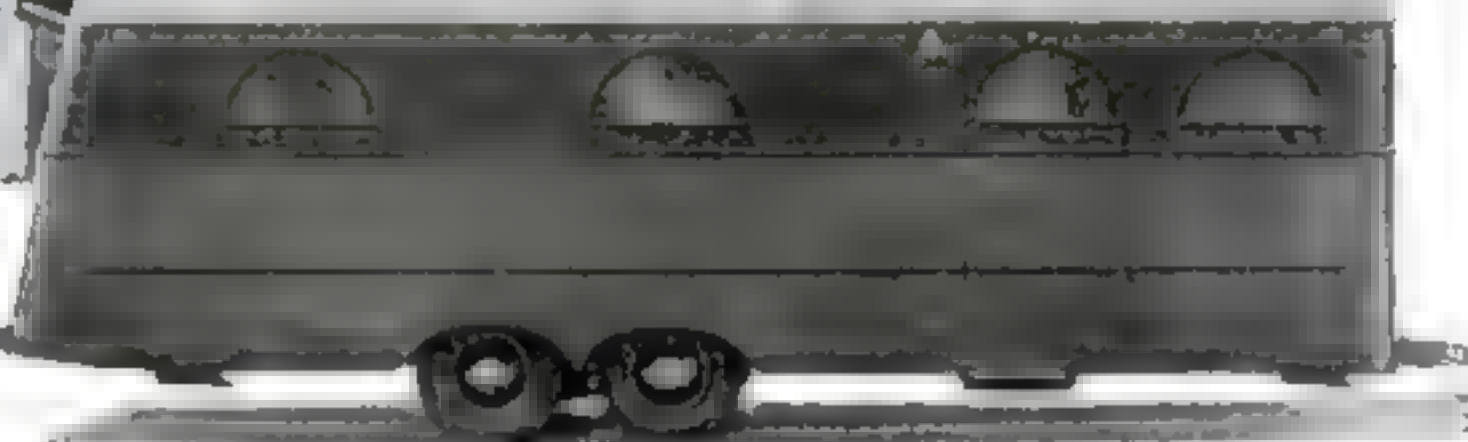




Giant Auto Trailer Boasts Double-Duty Windows

A GIANT among trailers, the latest model offered by a well-known maker measures more than twenty-four feet in overall length, with corresponding roominess and comfort. Tandem wheels support the all-steel body. An innovation in windows replaces the conventional push-out type. Circular window frames revolve at a touch, exposing either a semicircle made of glass or one of copper screening in the half-moon window openings in the sides. Thus windows are easily opened and shut, and are always closed against insects.

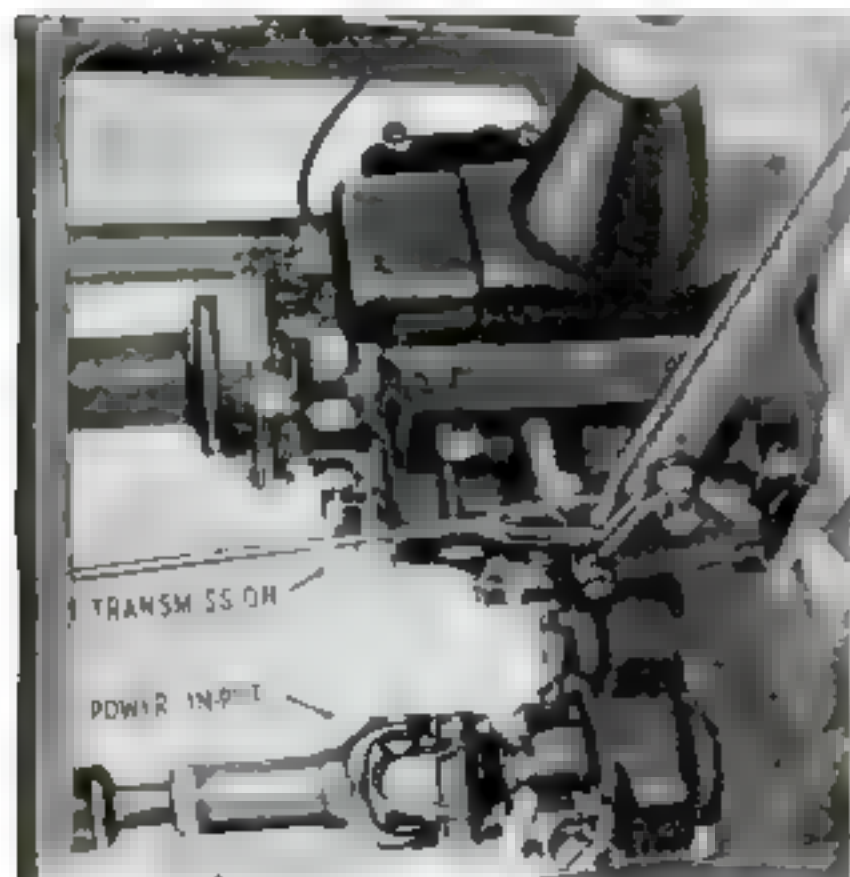
Half of each round sash is screen, half glass. Either may be revolved into place



Booster Engine Helps Truck Up Hills

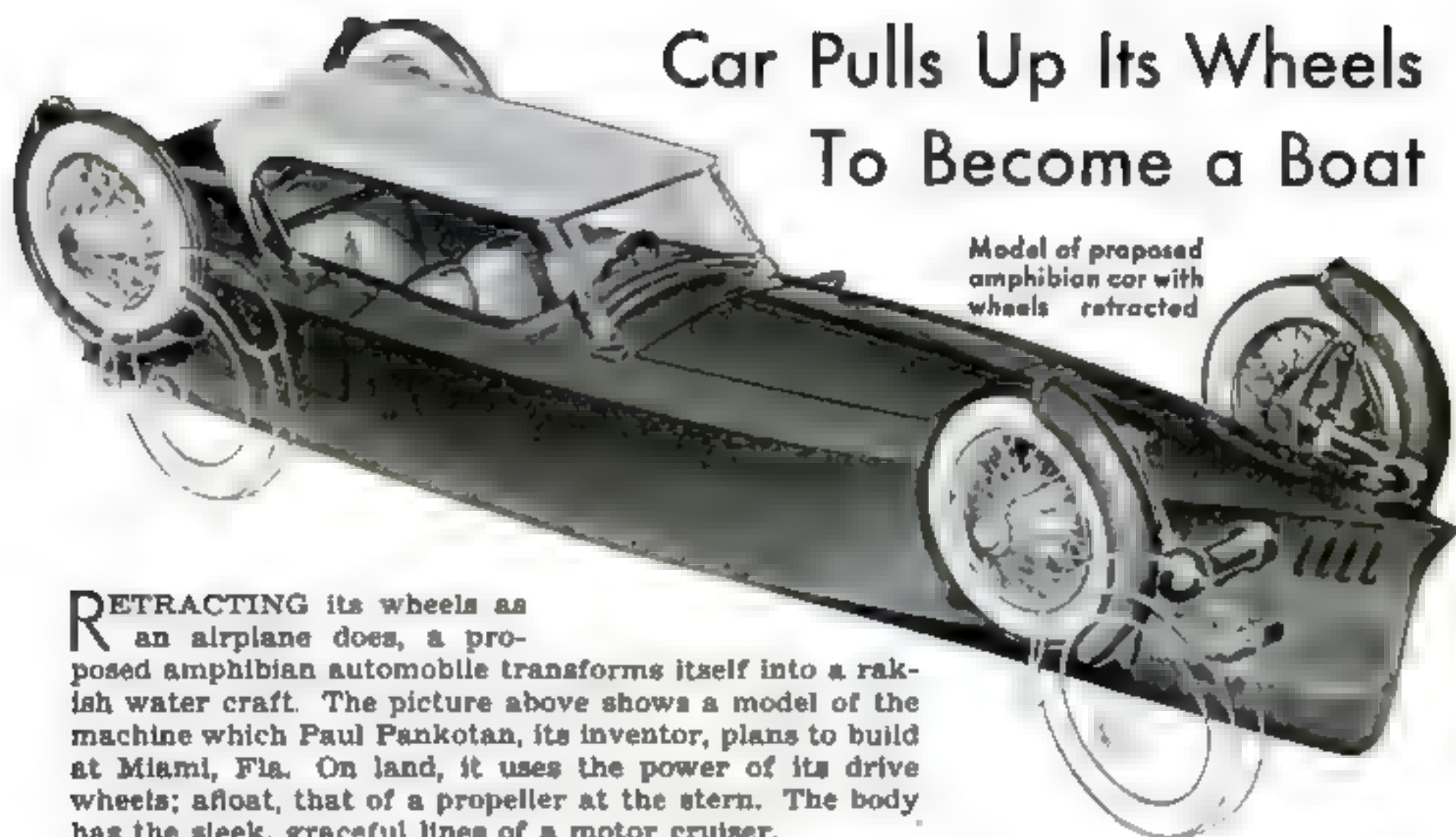
UP HILL and down dale, a driver may maintain a constant pace with the aid of a new auxiliary motor built into a truck, behind the cab. The booster consists of a small four-cylinder gasoline motor that feeds its power into the transmission. Automatic controls start it when the truck slows up on a hill, and it shares the load with the main

engine. As soon as the truck regains cruising speed, the booster unit automatically shuts off, standing by until it is needed again. It also aids in a quick get-away from a standing start. A light truck using the booster is said to equal a higher-powered vehicle in performance, at considerably lower operating cost.



The booster engine delivers power to the truck through the transmission by means of the coupling shown at left. Mounted behind the cab, the motor is kept warm by water from the main engine when not in use

Car Pulls Up Its Wheels To Become a Boat



RETRACTING its wheels as an airplane does, a proposed amphibian automobile transforms itself into a rakish water craft. The picture above shows a model of the machine which Paul Pankotan, its inventor, plans to build at Miami, Fla. On land, it uses the power of its drive wheels; afloat, that of a propeller at the stern. The body has the sleek, graceful lines of a motor cruiser.

Coupling Device Allows One-Man Tow

WITH the aid of a new coupling device, a driverless car may be towed safely through traffic and around corners. At each end of the triangular towbar, fabric-lined clamps may quickly be tightened by hand wheels. One of them grasps the rear bumper of the tow car. The other two clamp over the front bumper of the machine to be towed. Because the clamps fit tightly, the car behind has no tendency to swing out of line, and will follow the tow car around curves and right-angle bends as long as a reasonable speed is maintained. Its steering wheel turns, meanwhile, as if guided by an invisible hand. Pivots provided in the towing hitch enable the cars to move up and down independently when driving over rough roads. According to the makers, the device fits practically all types of bumpers and can be attached in a few minutes' time without danger of marring the finish of either of the cars involved.



With this triangular towbar, a driverless automobile can be towed through traffic and around corners. Upper view shows it in action



This time the motor turned over freely. And from every one of the spark-plug holes the oil gushed and spouted

Gus Brings in a Gusher

GUS Wilson, back from the weekly Kiwanis luncheon down at the Park House, saw an ancient but well-kept sedan in the shop which hadn't been there when he had left an hour and a half earlier. He knows all the Model Garage regulars' cars even better than he knows the regulars themselves, and at first glance he recognized the sedan. "What's the matter with Jack Kelly's bus now?" he asked Harry the grease monkey, who was staring at the car with a totally defeated look on his face.

"He says that he can start in second without any trouble," Harry detailed, "but that every time he tries to start in low, or goes into low after he has started, the engine stalls. It does, too. I tried it out. He says that he thinks the battery has something to do with it—that it's only a few months old, but that twice last week he had to keep his charger on it all night. But I checked the battery, and it's O.K. The job's got

me stumped!" He shook his head ruefully.

While Harry had been talking Gus had been loading up his pipe. Now he lighted it. "For the last year I've been telling Jack that he'd save himself some money by buying a new car instead of trying to get the last thousand miles out of this poor old junker," he remarked. "Well, I'll get my overalls on. While I'm doing it you take those floor boards up. We'll have a look."

When he came back a few minutes later, Harry had the floor boards up. Gus puffed reflectively at his pipe as he looked down at the exposed battery and transmission. "Stalls whenever he shifts into low, but runs all right in second and high," he thought out loud. "So it can't be the battery . . . Jack up the rear end, Harry."

Harry did as he was told. "Now get in, and start her up in second," Gus directed. The engine started easily and ran smoothly. "All right," Gus said after a few seconds. "Now shift into low and see what happens."

Harry shifted into low—and the engine stopped dead.

Gus laughed. "Switch her off, and come here, will you?" he said. "Notice the layout, Harry—battery on the right side, starting motor on the left side, and the cable between the battery and the starting motor lying on the clutch housing right in front of the transmission. On old models like this one, the rods which carry the shifting forks slide in and out of either end of the transmission." He got into the driver's seat. "Now I'll show you something queer—one of those little bugs that make mechanics who won't use their heads claw most of their hair out trying to figure what the heck is the matter. I'm going to shift into low—watch that right-hand rod when I do it."

Harry saw the rod shoot forward until its end came into contact with the cable.

"Now take a close look at the cable," Gus said. "See how the end of the rod has worn right through the insulation? Every time you shift into low, the rod comes into contact with the bare cable wires and causes a dead short. That

stops the engine, of course, and those shorts are what have been running the battery down. Wrap that worn place on the cable with a piece of sheet rubber and friction tape. Then cut a sheet-metal clamp, slip the cable under it, and fasten the clamp under one of those bolts that hold down the clutch inspection cover. That'll keep the cable out of the way of the rod. When you've finished, give Kelly a ring and tell him that his car is ready for him, and that he won't have a bit more trouble until something else on it wears out!"

Joe Clark, Gus's partner who runs the business end of the Model Garage, stuck his bespectacled face in at the door which leads from the shop to the office. "There's a call for the wrecker!" he said cheerfully. "It's from a man named Woodward who lives next door to Doc Marvin—new people in town. He can't get his car started, and he wants us to tow it in and see whether we can find out just what's the matter with it."

"Go and get it!" Gus told Harry.

Half an hour later, Harry, in the wrecker, carefully maneuvered a large car of expensive make into the shop. A stout, middle-aged citizen who looked both prosperous and perturbed got out of it. "I'm Mr. Woodward," he announced. "And you're Mr. Wilson, I take it. I've heard about you from Dr. Marvin. Six months or so ago I bought the house next to his and moved into it, but a few days later I was called out to the Coast on important business matters, and I just got back yesterday. I'm having trouble with my car, and the doctor assured me that you could help me."

"We'll be glad to try," Gus told him. "Just what sort of trouble are you having, Mr. Woodward?"

"I'll begin at the beginning," the new customer said. "When I learned that I would have to make a lengthy trip to the Coast, I knew that my car would not be used for several months. Mrs. Woodward has her own coupe, and she always has refused to drive this large car. So I decided to storage it—I be-

The Boss of the Model Garage Learned Long Ago That To Find the Trouble, You've Got To Know Where To Look

• • •
By MARTIN BUNN



"Notice the layout, Harry," said Gus. "Battery on the right side, starting motor on the left, the cable between them."

lieve that is the correct term—in my own garage. I'm a man who likes to do things for himself, Mr. Wilson, and I decided to lay up my car myself. After asking advice from several people, I jacked all four wheels off the floor, removed the storage battery, drained both the radiator and the gasoline tank, removed the spark plugs and put oil in the cylinders to prevent rusting, replaced the plugs, and carefully covered the car with several sheets to protect it from dust.

"This morning I decided that I would put the car back into service. Everything was exactly as I had left it. I am certain that no one had as much as lifted one of the sheets. After removing the jacks I replaced the battery—newly charged—and filled the radiator and the gasoline tank. But when I stepped on the starter absolutely nothing happened—there was neither sound nor motion, Mr. Wilson! I tried again and again, but I couldn't get the motor to turn over. Finally, in desperation, I was about to call up the garage in the city which used to take care of my cars, when Dr. Marvin happened to hear of my difficulty and came over to recommend you. Now, what in the world do you suppose can be wrong?"

"I don't see how it can be anything very serious," Gus reassured him. "But it may take me some little time to locate the trouble. Harry can drive you home, and when . . ."

"No, no—I'm interested. I'll wait!" Mr. Woodward said, and settled himself comfortably on a reasonably clean spot at the end of the workbench.

Gus tested the battery, and found that it had a satisfactory kick. He checked the wiring. It was in perfect condition. He could find nothing wrong with the carburetor. But when he stepped on the starter, the same thing happened as had happened when Woodward had stepped on it—exactly nothing at all.

"See—I told you!" the new customer said, almost happily.

Gus took time out to refill his pipe and to do a little hard thinking. "Are you dead certain that you lubricated every cylinder?" he asked after he had fired up. "If you missed one, it is just possible that its piston has rusted fast to the cylinder wall."

"I didn't miss any of them," Woodward

maintained. "I am absolutely certain that I put oil in each and every cylinder. I was especially careful about that."

"Then it can't be rust that's causing the grief," Gus said. "Harry, put blocks in front and back of a rear wheel and jack up the other, will you? Then put the car in high gear. Leave the ignition off."

Harry did as he was told. Then Gus grasped the raised wheel and tried to turn the engine over by hand. He couldn't move it.

There was a queer expression on his face when he straightened up. He looked at Woodward, started to say something, and then changed his mind. He turned to Harry instead. "Take her off the jack, now, and remove the spark plugs, please," he told him. "All of them."

When Harry had again carried out his boss's instructions, Gus got into the car. "Stand clear, everybody," he said, stepping on the starter.

This time the starting motor turned over freely, and so did the engine. And from every one of the eight spark-plug holes gushed and spouted oil!

"That's the answer," Gus said as he got out of the car. "Oil lock. No harm done, Mr. Woodward. I'll have your car cleaned up so that you can drive it out of here within a half hour. But tell me—just how much oil did you put in those cylinders?"

"Why I filled each cylinder with oil," Woodward said. "Wasn't that right?"

"This," Harry remarked as he and Gus were washing up at quitting time that afternoon, "has been one of those screwy days. First that cockeyed job of Jack Kelly's, and then that dumb-chuck stunt of this new Mr. Woodward's. Say, I almost busted keeping from laughing when all that oil came spouting out of his engine!"

"I would have busted you if you had laughed," Gus assured him.

"Sure—I know that," Harry agreed. "But it was funny, and you darned near laughed yourself. How did you catch on to what it was, Gus?"

"By the feel when I tried to turn that engine," Gus told him. "I'd got the same feel when I tried to move an engine whose cylinders were full of water."

"Gee, you can find all the answers, can't you?" Harry said admiringly.

"That," Gus said, "is because I usually know just where to look for them!"

GUS SAYS:

Modern carburetors have acceleration pumps which most car owners ignore. Take a look at yours and you'll see it's adjustable for summer and winter. With warm weather here, it's time to reset it. It will pep up your pick-up and save gas.

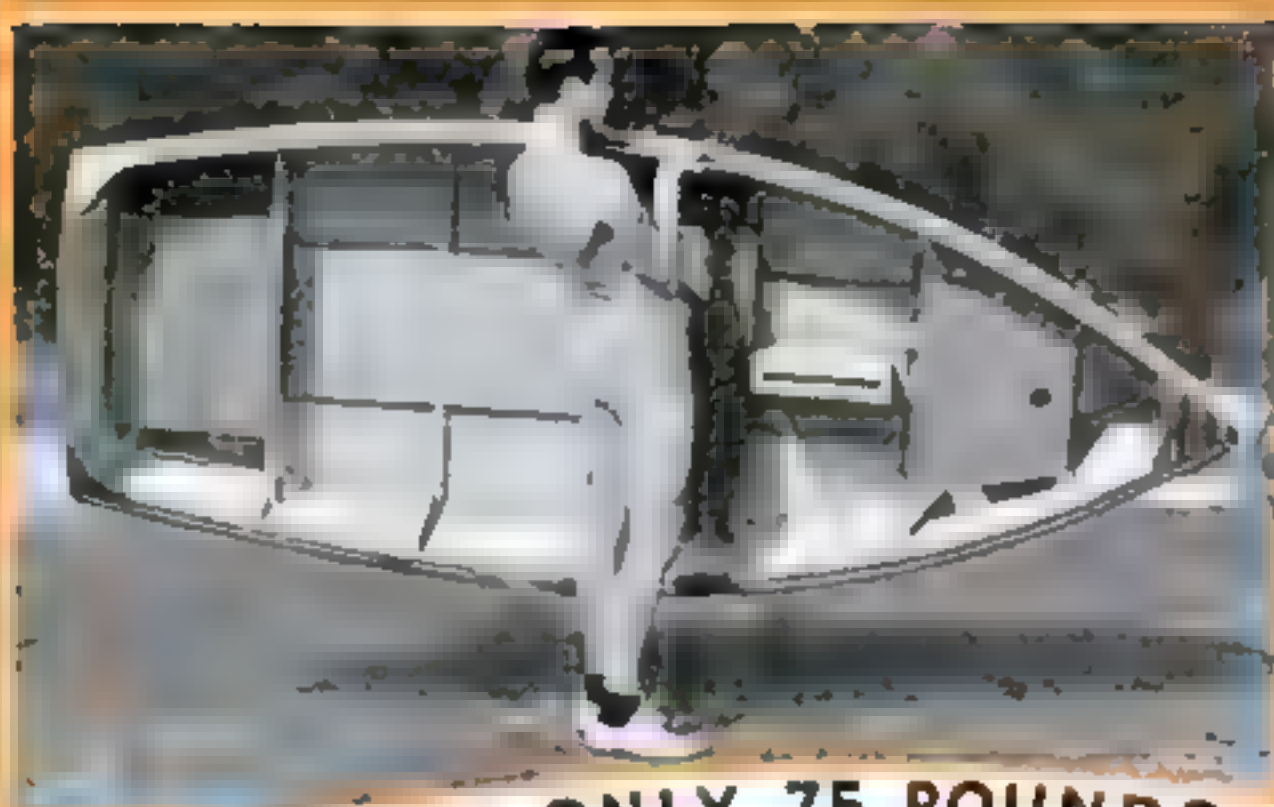
THE HOME WORKSHOP



In This Issue.. WOODWORKING • KINKS • CRAFTWORK

By **BRUCE**
and **WILLARD**
CRANDALL

Anyone
can build this
very simple utility
boat...it is portable,
entirely leakproof,
and low in cost



WEIGHS ONLY 75 POUNDS...



Plywood Sailing

ALTHOUGH extremely easy to construct, this new lightweight portable boat *Breeze Along* is adapted to many uses. It is ideal as a car-top boat for fishing and hunting trips, as a tender for any small cruiser, or as a general-utility boat

around a bathing beach, yacht club, or summer cottage. It may be powered by oars, sail, or a small outboard motor and is so light that it need never be left in the water.

Because of the plywood construction, the dinghy will be water-tight at all times. There are practically no seams, and plywood does not expand and shrink like ordinary lumber. The use of plywood also simplifies the job of planking; there is no rabbeting

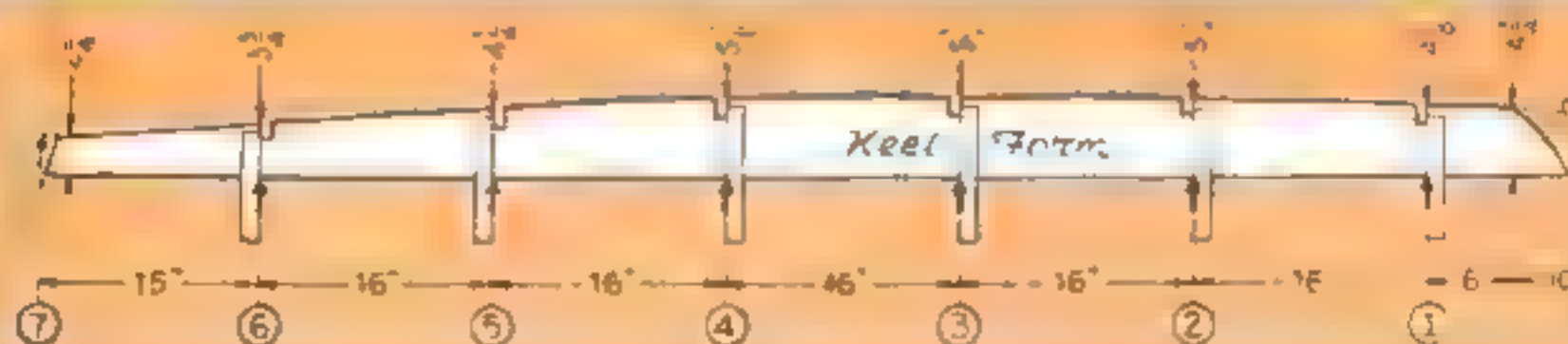
or other complicated construction work of any kind.

As plywood is exceptionally strong, the entire boat may be built to weigh as little as 75 lb. It can be carried by one man. The rudder, centerboard, and mast are easily removed so they may be carried separately.

When used for fishing, the boat will have plenty of buoyancy and stability for three adults, and when used as a sailboat there is still ample room for two. If the boat is not to be used for sailing, a small keel about $\frac{3}{4}$ " by 1" can be used in place of the one shown. The skeg, centerboard well, mast step, and partner are also eliminated, bringing the total weight of the boat down to 60 lb. or even less.

Spruce is the lightest satisfactory material that can be used for the framework, and does not need to be over $\frac{3}{8}$ " thick for frames and chines. Be sure the plywood used is of the new resin-bonded waterproof type.

If the boat is built without sailing equip-





LENGTH 9-7"
 BEAM 46"
 DRAFT *incl skeg* ... 4"
 DEPTH AMDSHP. ... 15"
 WEIGHT ... 60-75 LB.
 COST OF MATERIALS, ETC.
 MOTOR 3-1 HP
 SPEED 4 MPH

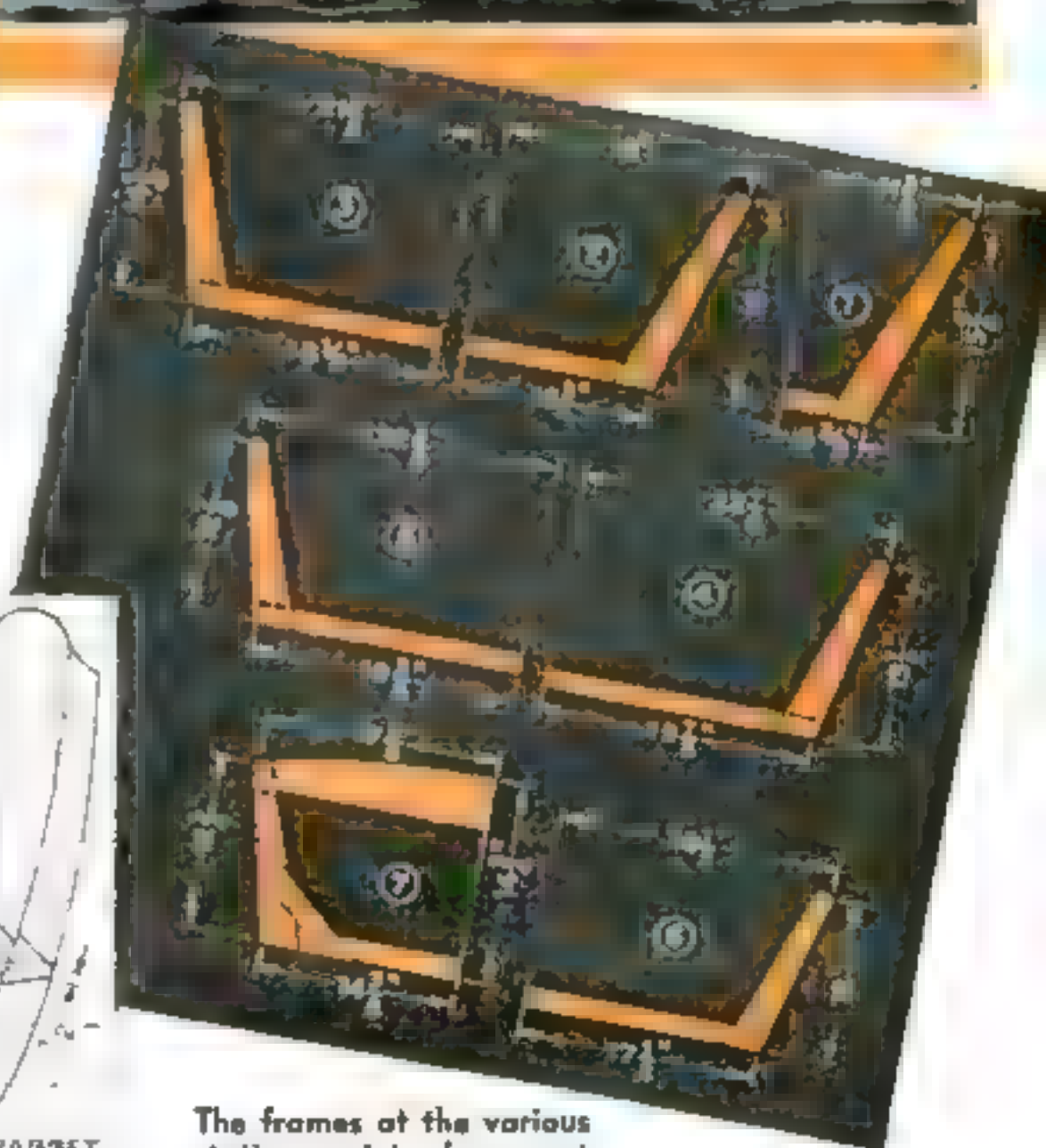
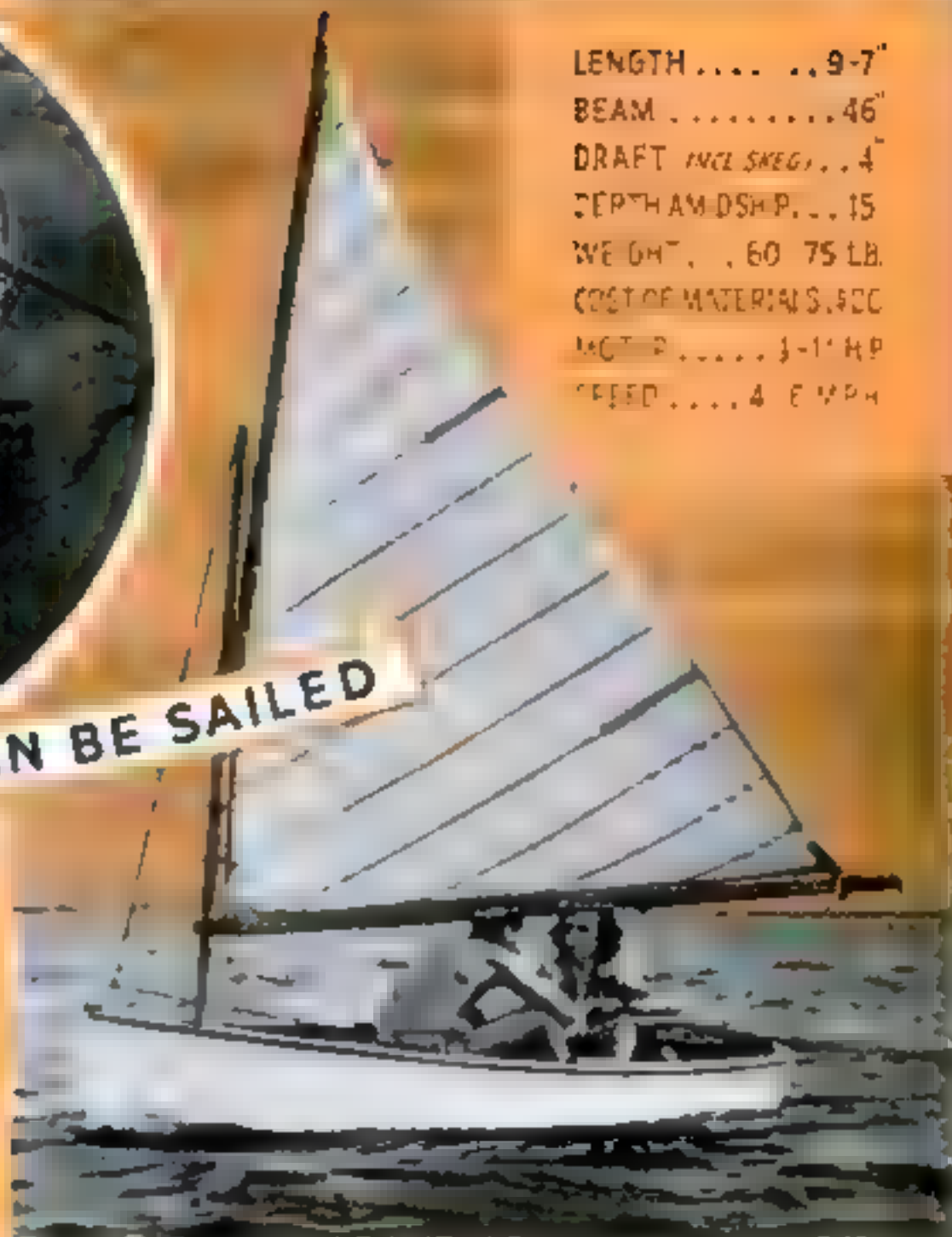
... CAN BE ROWED... CAN BE SAILED

Dinghy

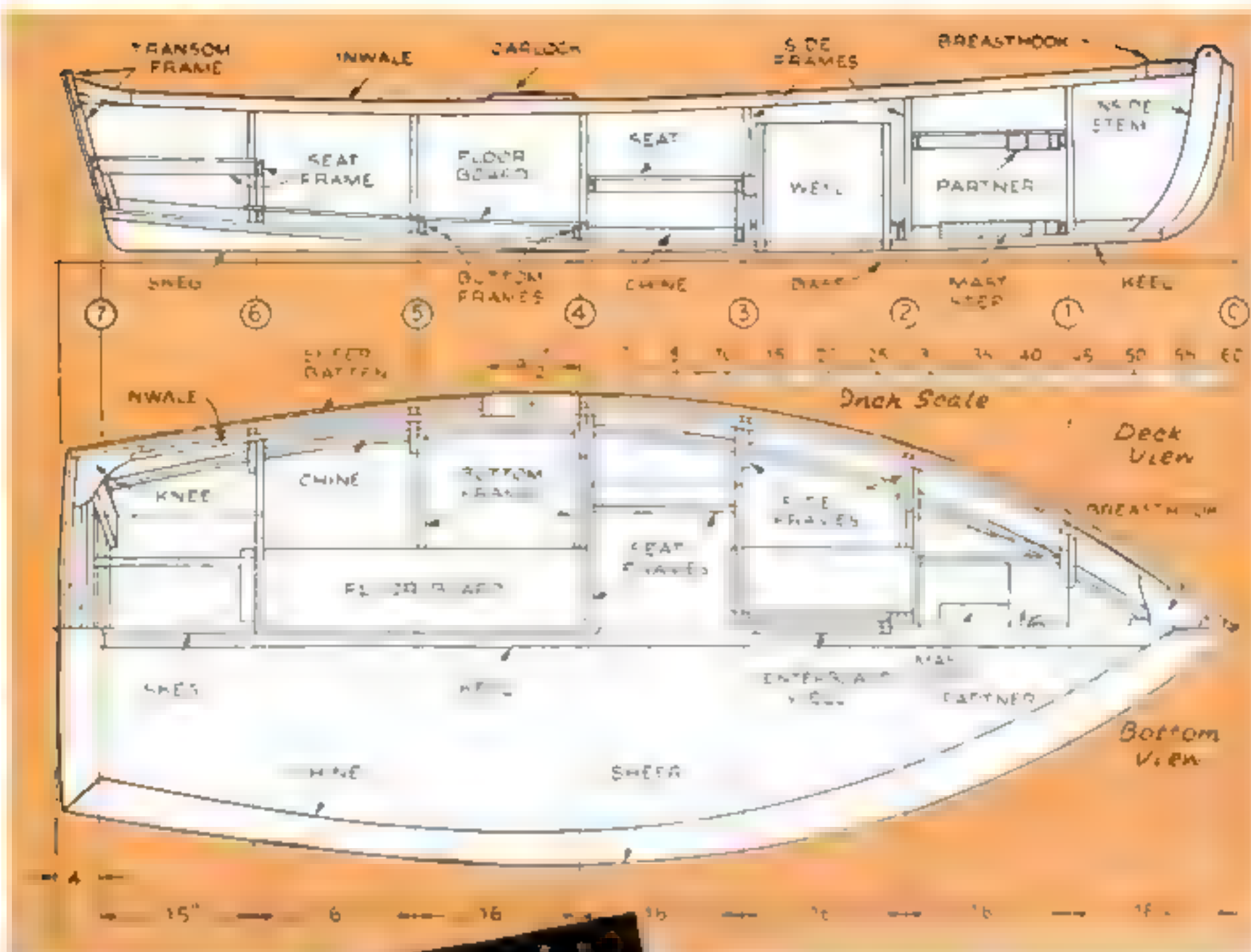
ment, the total cost, excluding oars, will be from \$15 to \$25. The exact figure depends on the quality of material used and the local lumber prices. Including all sailing equipment and a sail made by a professional sailmaker, the total cost should be between \$40 and \$50.

The first step in building the boat consists of drawing full-size patterns of the frames, transom, and stem on wrapping paper, following the measurements given in the drawings. If preferred, the paper patterns may be purchased already drawn. The measurements given in the table of offsets are to the outside of the boat without any allowance for the planking thickness or for the transom angle and bevel. It is, however, not necessary to use the table of offsets unless you wish to draw the entire boat full size yourself before making the patterns.

The bottom frames are straight 1 1/4" pieces,



The frames at the various station points (see next page), and stem pattern



Complete assembly views of the boat. At the left are the cross-section lines and table of offsets giving dimensions

spaced about 3" apart. Coat the surfaces with marine glue before fastening. If an outboard motor is to be used, a motor block with grain running vertically is screwed to the outside of the transom.

Next nail temporary pieces across the top of the side frames. From the patterns, mark the center line on these pieces, on the bottom frames, and on the transom. When cutting out the stem, saw it down the rabbet line as well, and save the outside piece to be put on after the boat is planked. In this way all the work of rabbeting the stem and fitting the side planks into the rabbet is eliminated.

The boat should be built upside down on a framework supported from the floor, or from two large timbers as shown in the photographs. The keel form, which is the essential part of the framework, is cut from a 10' plank according to the measurements given in the drawings, and notches are cut at the proper points deep enough so that the bottom frames are flush with the keel form. Nail uprights to the keel form at each station, set the form up, and brace it at a con-



| TABLE OF OFFSETS | | | | | | | | | |
|---|------|------|------|------|------|------|------|------|--|
| DIMENSIONS IN INCHES AND EIGHTHS TO OUTSIDE OF PLANKING | | | | | | | | | |
| STATION | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| HALF BREADTHS | | | | | | | | | |
| SHEER | | 11-4 | 18-1 | 21-6 | 23-0 | 22-4 | 20-5 | 17-4 | |
| CHINE | | 5-4 | 13-7 | 18-2 | 20-0 | 19-4 | 17-5 | 14-4 | |
| HEIGHTS FROM BASE | | | | | | | | | |
| CHINE | 3-0 | 2-5 | 2-1 | 2-0 | 2-1 | 2-5 | 3-6 | 5-0 | |
| SHEER | 20-0 | 18-4 | 17-3 | 16-3 | 15-7 | 15-7 | 16-0 | 17-0 | |

and the two side frames are made by ripping a 4" board. Lay the frame stock over the patterns, mark and cut to shape, and then fasten the frame pieces together over the patterns. The frames are lapped at the chine and may be fastened with $1\frac{1}{4}$ " or $1\frac{1}{2}$ " screws, or with bolts or copper rivets. Allow enough space for the chine notches and the beveling of the forward frames.

The plywood transom is screwed to the transom framework with $\frac{3}{8}$ " No. 7 screws



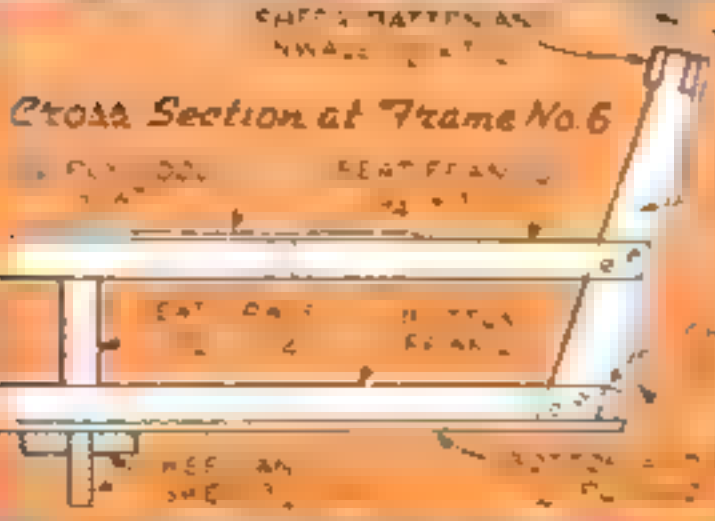
venient height for working. The uprights should all be perfectly plumb and at right angles to the keel form.

The frames are placed in the notches in the keel form and temporarily fastened to the uprights. Make sure first that each bottom frame is perfectly level, that the keel form is perfectly straight, and that the center line of each bottom frame is at the center of the keel form. The inside stem and transom can also be temporarily fastened in place. The stem and center line of the transom must both be plumb.

Notches can now be cut for the chines and sheer battens. Clamp a batten in position before cutting the chine notches, to make sure that the chines will take a true curve and to get the proper angles of each chine notch. The chines should be cut down to some extent where they enter the stem because too deep notches would weaken the stem. Also, the notches



From top down: Fastening chine, the transom, setting up keel form, securing the uprights, and cross section

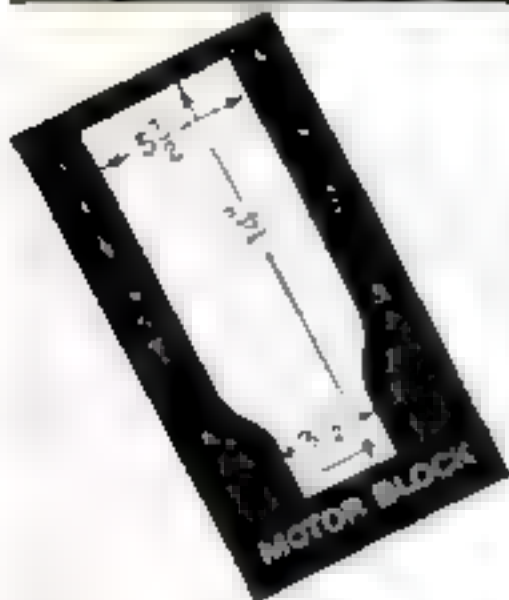


should be cut only about two thirds of the way into the transom frame for the best construction.

The chines should be fastened to the side frames and transom frame with $1\frac{1}{4}$ " No. 7 screws and to the stem with $1\frac{1}{2}$ " No. 8. Both chines should be fastened at the same time, to prevent pulling the framework out of line. Before the chines are fastened, make sure that the transom and all frames are at right angles to the keel form. The side frames must also be plumb before the sheer battens are fastened in place.

Next, the frames, transom, chines, and stem should be cut to a bevel in such a way that the planking will fit perfectly. Check carefully to make certain that the sides will bend in a perfectly true curve. This can be done by bending a batten over the frames, stem, and transom at various places fore-and-aft and then standing off at a distance and determining if the batten bends in a pleasing curve and still touches each frame. The inside stem should be dressed down enough so that the outside stem will cover the forward ends of the side planking when it is attached.

(TO BE CONCLUDED)



Above, when fastening the sheer battens, leave room for screws needed to hold inwale. Right, beveling framework ready for planks

LIST OF MATERIALS

| Waterproof marine plywood | | |
|--|----------|---|
| For | No. Pcs. | Size |
| Planking transom, seats, floor etc | 2 | 3 16" or $1\frac{1}{4}$ " x 4' x 10' |
| Spruce, mahogany, oak, cedar, fir, cypress, pine, or redwood | | |
| Chines bottom frames, seat frames, and oarlocks | 4 | $3\frac{1}{2}$ " or $3\frac{3}{4}$ " x $1\frac{1}{4}$ " x 16' |
| Side frames, keel, and skeg | 2 | $3\frac{1}{2}$ " or $3\frac{3}{4}$ " x 4' x 14' |
| Sheer battens and inwales | 4 | $1\frac{1}{2}$ " x $1\frac{1}{4}$ " x 10' |
| Stem, breasthook, and knees | 1 | $1\frac{3}{4}$ " x 8" x 4' |
| Sheer molding (half-round) | 3 | 1" or $\frac{3}{4}$ " x 10' |
| Any cheap lumber | | |
| Keel form | 1 | 1" x 8" x 10' |
| Uprights and braces | 3 | 1" x 2" x 16' |

(Extra if boat is to be used with sail)

| | |
|---------------------------------|--|
| Spruce or fir | |
| Mast | 1 $2\frac{1}{4}$ " x $2\frac{1}{4}$ " x 8' |
| Gaff | 1 $1\frac{1}{2}$ " x $1\frac{1}{2}$ " x 8' |
| Boom | 1 $2\frac{1}{4}$ " x 3" x 8' |
| Oak, mahogany cedar, or cypress | |
| Centerboard, rudder, and tiller | 1 $3\frac{1}{4}$ " x 12" x 7' |
| Mast step and partner | 1 $1\frac{1}{4}$ " x 6" x 2' |

Note: Measurements marked with an asterisk (*) are net. The kinds of woods are given in the order of preference.

HARDWARE AND MISCELLANEOUS

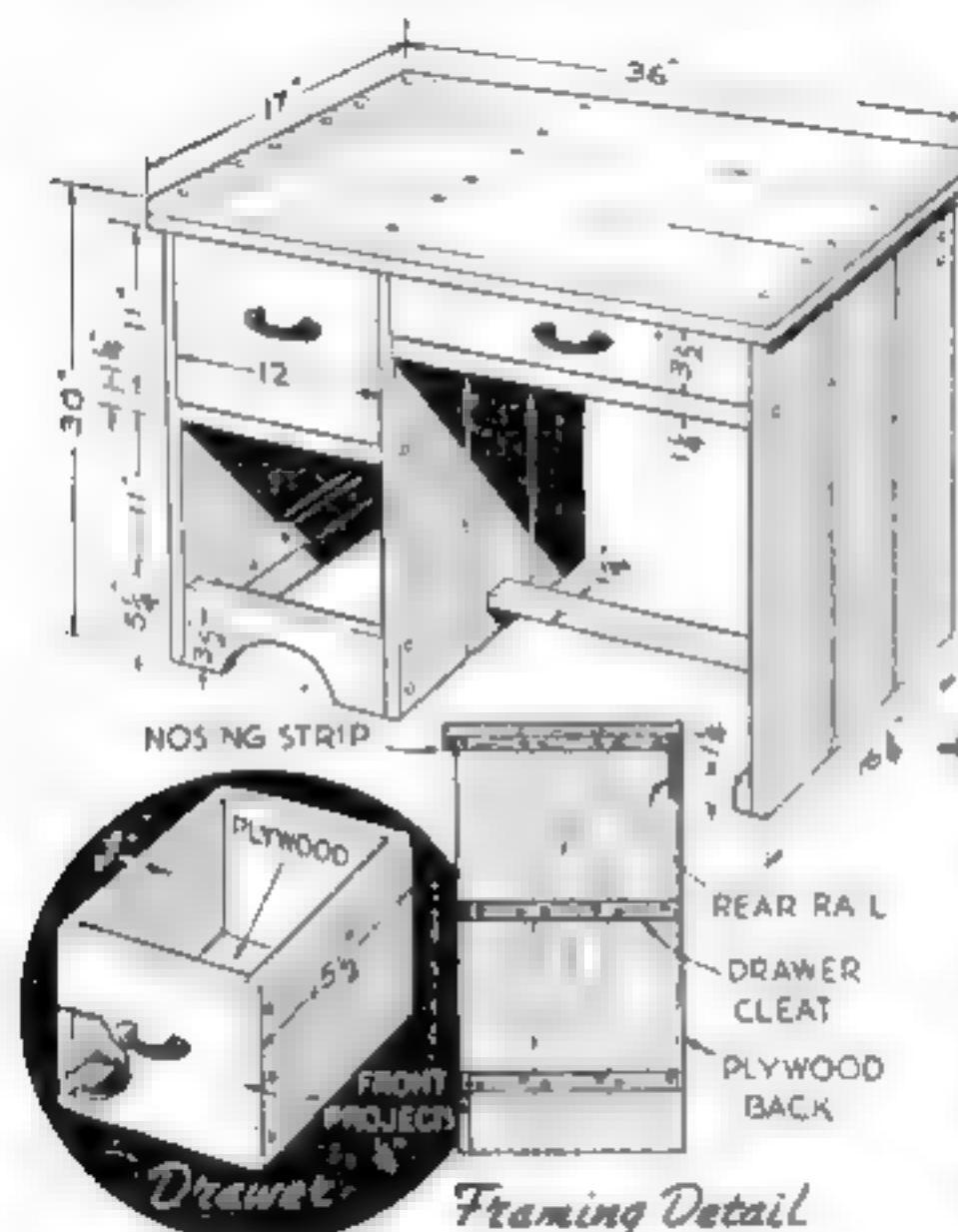
Flathead brass, galvanized, or cadmium plated screws as follows: 3 gross $\frac{1}{4}$ " No. 7 3 gross $1\frac{1}{4}$ " No. 7 6 doz 1 $\frac{1}{2}$ " No. 8 6 doz 2" No. 10 Copper or galvanized nails, $\frac{1}{2}$ lb 1" 1 pr oarlocks 1 pr 6 or 7' oars 1 pt marine glue $\frac{1}{2}$ gal marine paint, 1 qt. spar varnish

(Extra if boat is to be used with sail)

5 of $\frac{1}{2}$ " galvanized iron rod 6- $\frac{1}{4}$ " x 4" galvanized carriage bolts 2 eye blocks, 2 pinners 2 gudgeons 2 pins for mast and boom 1 gal 2" diameter glue for mast 1 qt. 1" glue 1 gal 4-oz. zinc dust



A SIMPLY BUILT White-Pine Desk IN NATURAL FINISH



with screws and put a strip under the top at front and ends to increase the apparent thickness. If the cleats have been slotted in the way recommended, the end strips also should be slotted and screwed on without glue. Brace the right end of the desk with a stretcher resting on the lower cleat.

Make the drawers with the sides rabbeted into the fronts as shown. The fronts do not push back flush with the desk front, but project $\frac{1}{4}$ " and have rounded corners.

Improving Old Tennis Balls

LONG before a tennis ball loses its resiliency, its nap becomes matted and worn so that its air resistance is lowered and a player's control over it is lessened. Gently roughing it with a wire brush will restore the nap and give added use.—J. B. CLEVELAND.

BECAUSE of its blond finish and simple lines, this desk has a distinctly modern appeal. It is of white pine finished with white shellac and set off with blue drawer pulls. All parts are fastened with screws, the exposed heads of which are countersunk $\frac{1}{4}$ " and hidden with plugs cut from hardwood dowel stock.

Glue up the top and vertical members from three pieces of dressed 1" lumber. Chamfer the joint corners on the exposed faces of the ends and partition to show V-grooves. When these parts are cut to size and sanded, screw on the cleats that serve as drawer slides, cutting them short to allow for the drawer-rail ends in front and the back upper rail and plywood back. If the rear screw holes in the cleats are lengthened into short slots, and the screws are passed through washers, there will be sufficient allowance for the shrinking and swelling of the wide parts.

Attach the top and rails

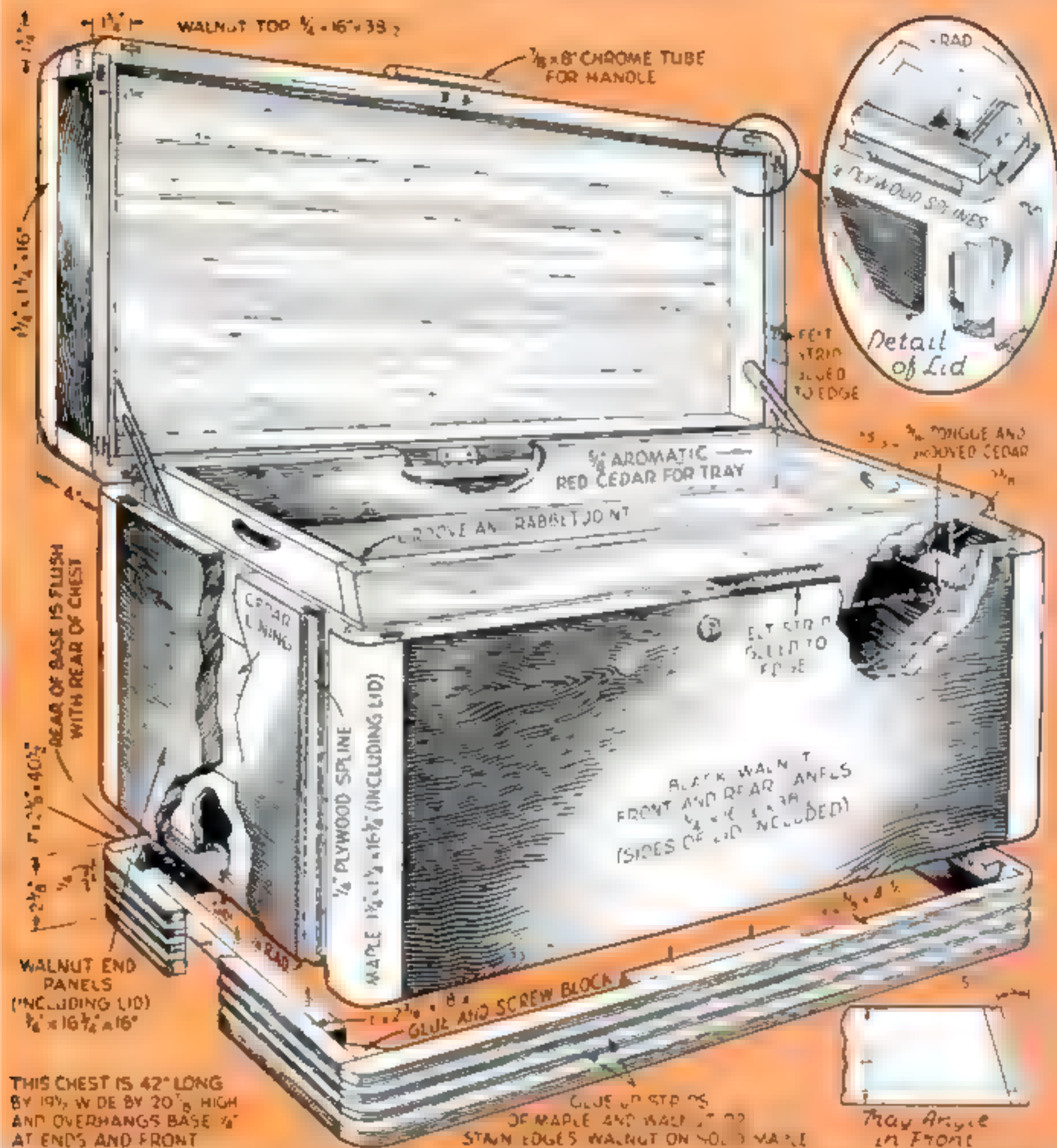
Punch Countersinks Holes in Wood

HOLES for flathead wood screws can be countersunk very quickly, especially in soft wood, by using a conically pointed tool made as shown from a $\frac{1}{2}$ " bolt or steel rod. It is tapped with a hammer and presses down the wood around the drilled hole. You seldom have to tap it twice.



Beautiful Modern

IN BLACK WALNUT



LIST OF MATERIALS

WALNUT—DARK

- 1 panel $\frac{3}{4}$ " by 16" by 38"
- 2 panels, $\frac{3}{4}$ " by 16" by 38"
- 2 panels, $\frac{3}{4}$ " by 16" by 16"

MAPLE WHITE

- 2 pieces $1\frac{3}{4}$ " by $1\frac{3}{4}$ " by 42"
- 2 pieces, $1\frac{3}{4}$ " by $1\frac{3}{4}$ " by 16"
- 4 pieces, $1\frac{3}{4}$ " by $1\frac{3}{4}$ " by 16"

MAPLE OR BIRCH FOR BASE

- 1 piece, 1" by $2\frac{3}{4}$ " by 41"
- 1 piece, 1" by $2\frac{3}{4}$ " by 40"
- 2 pieces, 1" by $2\frac{3}{4}$ " by 18"

RED CEDAR

- 40 square feet, tongue-and-grooved, $5/16$ " thick
- 15 square feet, $5/8$ " thick, for tray

MISCELLANEOUS

- Chromium plated tube 8" by $\frac{1}{8}$ " for lid handle
- 1 piano hinge or 3 nickel-plated chest or butt hinges
- 2 sliding stays
- 1 chest lock

Chest

AND MAPLE

CONSTRUCTED of black walnut and maple and lined with aromatic red cedar, this distinctive chest is enhanced by the beautiful color contrast of the woods.

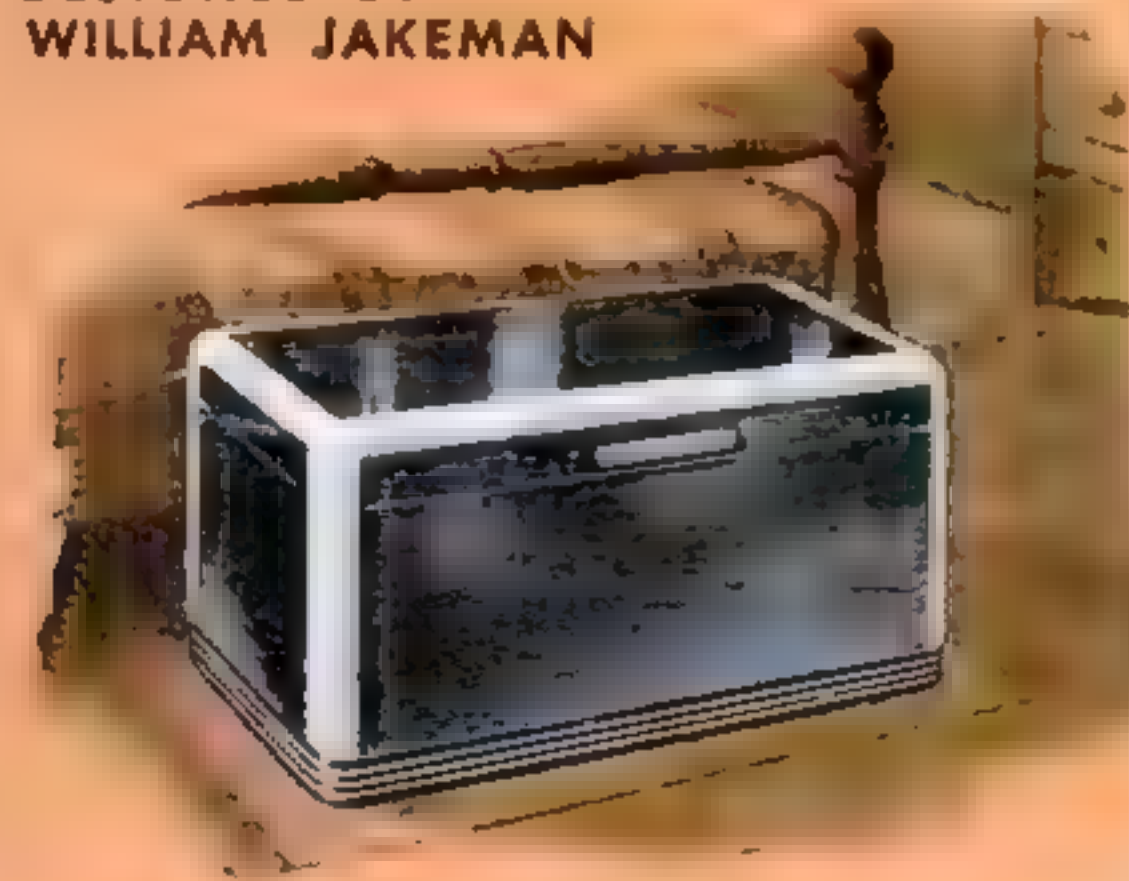
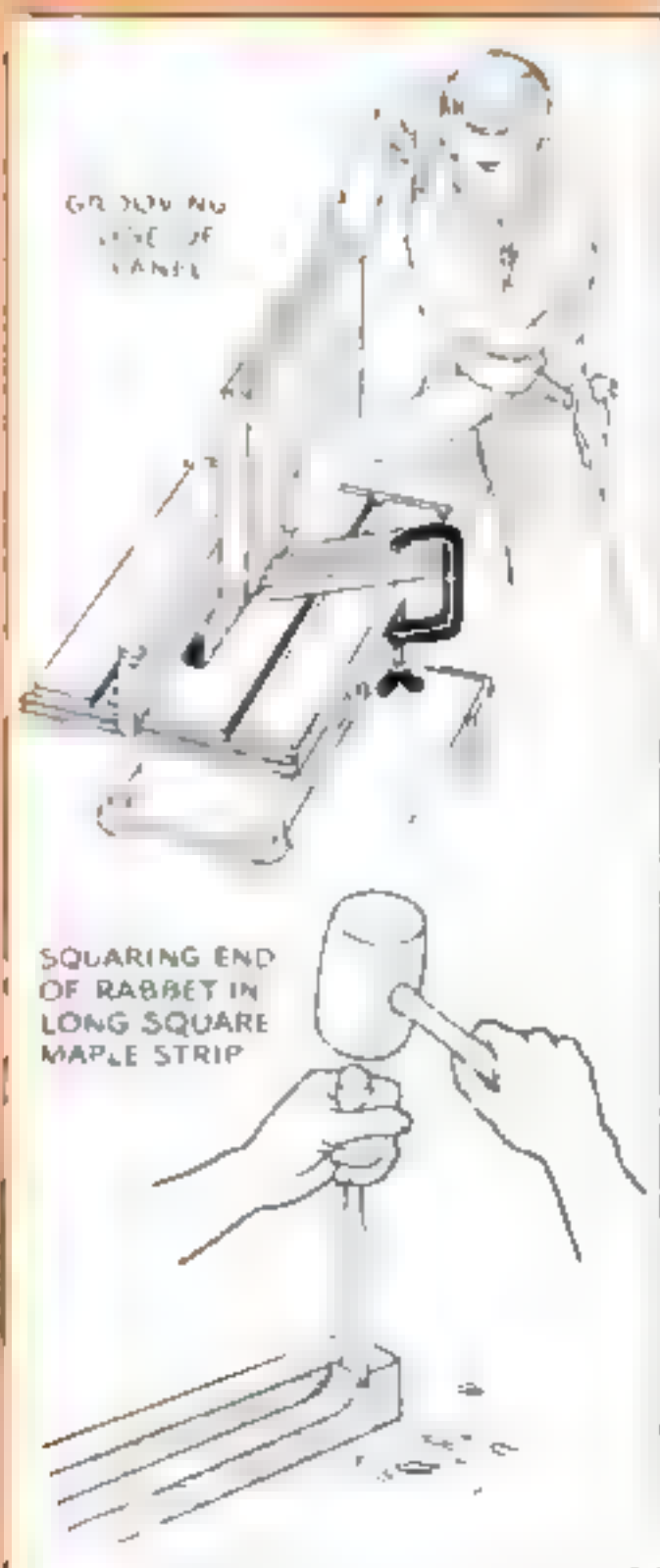
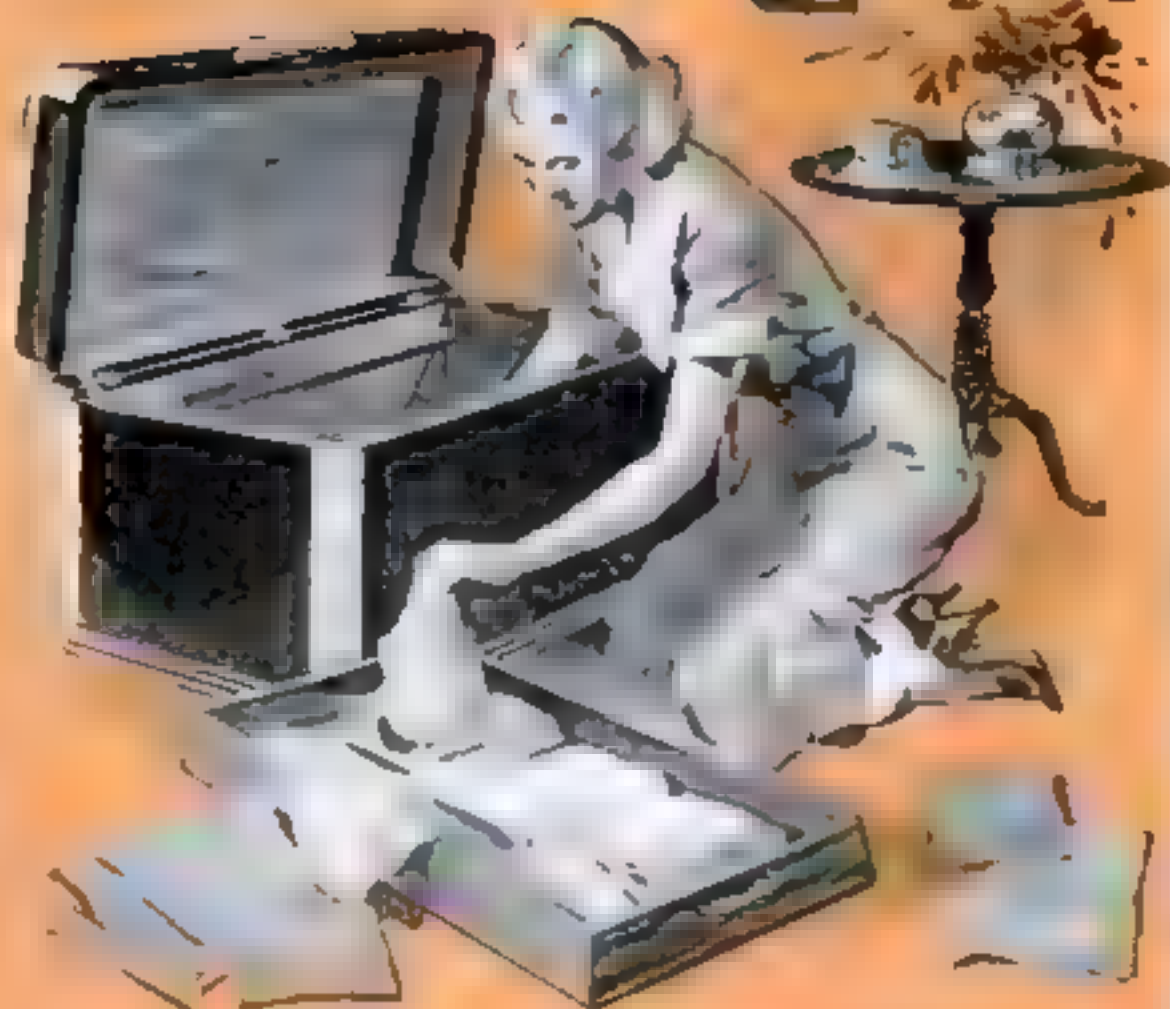
First, glue up and groove the panels. Groove the $1\frac{3}{4}$ " maple strips at the same time; then rabbet them out to make a 1" square recess, which forms square corners on the inside of the chest. Rip $\frac{1}{2}$ " plywood strips about 1" wide for the splines.

Glue the strips to the ends of the top panel; then glue the long strips to the sides of the same panel. Next glue the splines to the vertical strips. Now slide the side panels onto these vertical strips from the bottom.

The 4" deep lid is ripped off on the circular saw after the joints have all been glued and the corners rounded off. The chest is then lined with aromatic red cedar and the tray made. Note that the base may either be glued up of alternate walnut and maple strips, or made of maple and the dark parts stained.

Unless the maple is very light, bleach it white and protect with thin white shellac. Stain and fill the walnut; then apply a rubbed varnish finish or use clear lacquer. Leave the cedar unfinished.

DESIGNED BY
WILLIAM JAKEMAN



Shapers, Sanders, and Other

PART VIII
OF A NEW SERIES
FOR BEGINNERS
By Edwin M. Love



Adjusting a shaper cutter for height. Right, shaping work free-hand. Note the starting pin

Should the amateur craftsman buy a woodworking shaper? Will he get enough use out of it to be worth while?

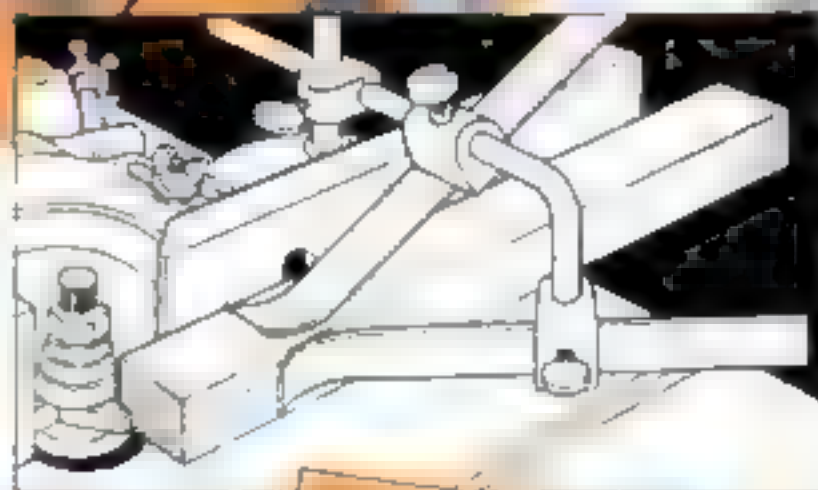
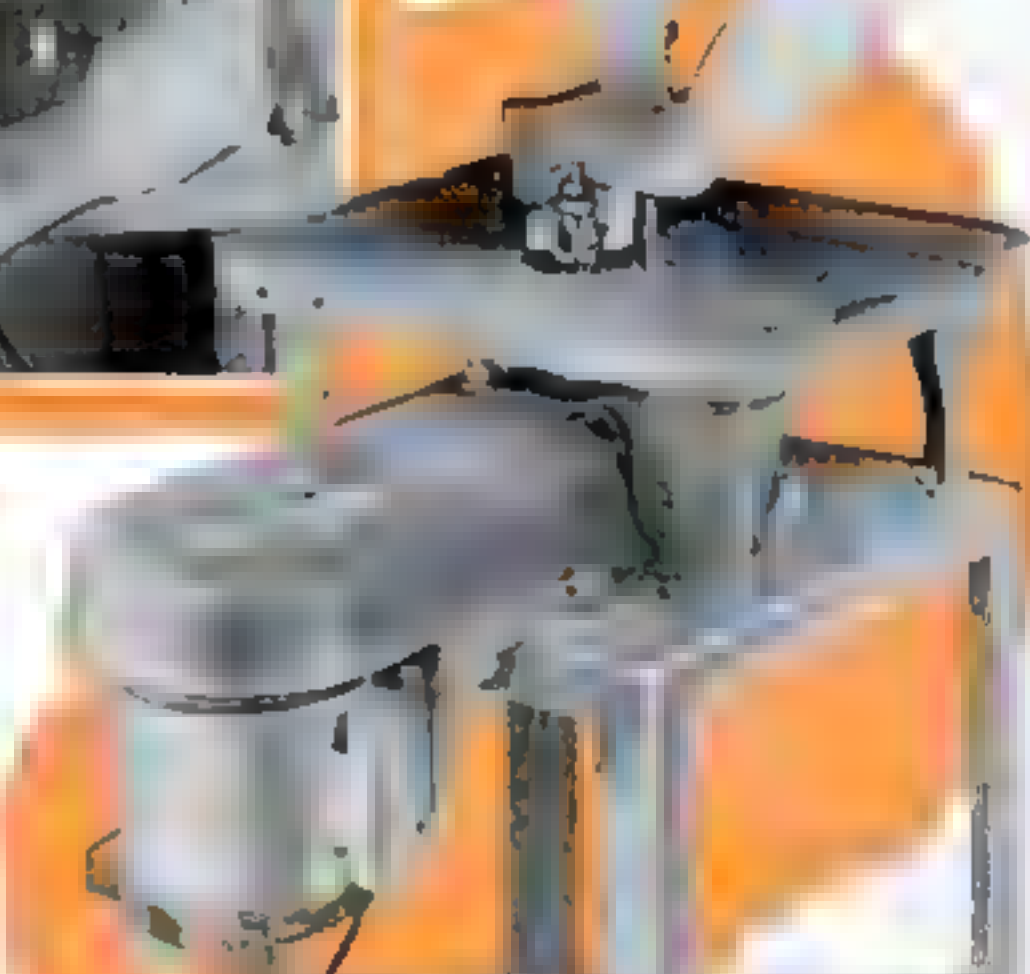
While both the circular saw and drill press can be used for shaping, sooner or later a home-workshop enthusiast feels the need of a machine designed especially for this work. A shaper is more convenient, does better and faster work, and handles a wider variety of jobs.

How large a shaper does the home mechanic need?

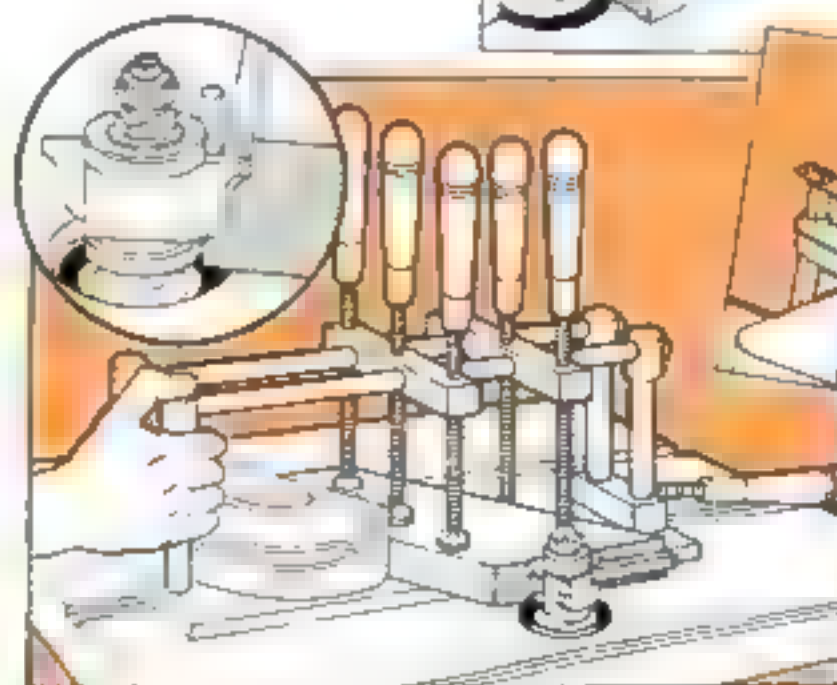
Obviously, it should be large and complete enough to do the work better than an adapted machine. A popular bench machine has a table 18" by 15½". Floor models have tables about 20" by 27". Such shapers use from two to four sizes of cutters, ranging from 5/16" to ¾" in bore.

What accessories are there?

There is a two-section



At right, spring hold-downs. In circle below, a depth collar guides edge of work



Above, ring guard on shaper. Left, sliding jig to hold work while shaping tenon on end

Woodworking Machines

fence, special cutting heads, stub spindles for cope cuts where one molded edge intersects another, and sets for making lock joints, box corners, and the like.

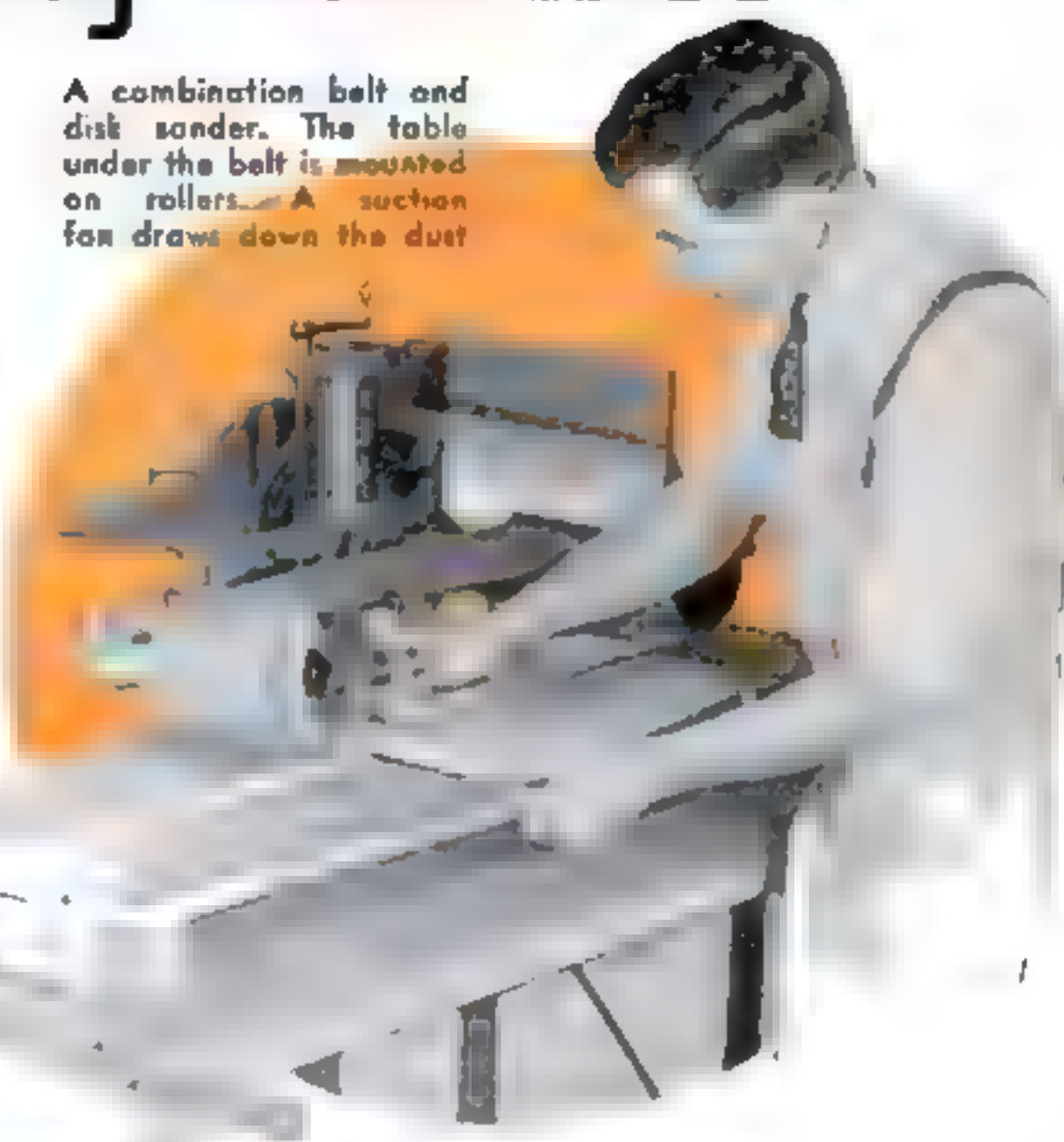
How is the machine guarded for safety?

The fence gives much protection. Spring hold-downs help keep fingers from the knives, and push sticks are handy. For free-hand work, a tapered pin inserted in a hole in the table steadies the start of the cut. A ring or cup-shaped guard can be placed over the cutter.

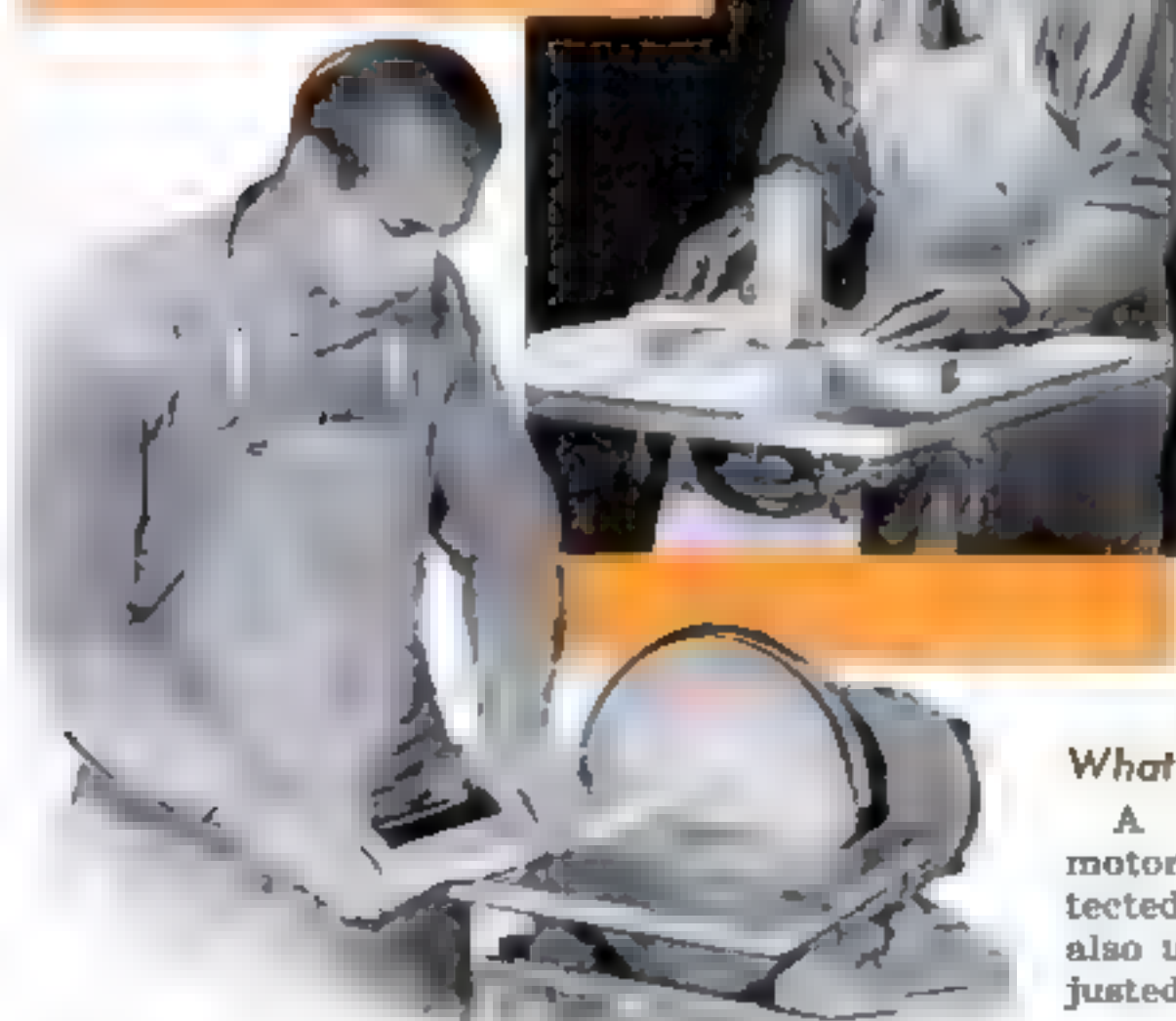
How are cutters mounted?

Two or more threaded arbors are supplied. These are tapered or fitted with cone nuts to bolt rigidly into the machine spindle. Sometimes the spindle itself has

A combination belt and disk sander. The table under the belt is mounted on rollers. A suction fan draws down the dust



A spindle sander with a vertical drum that moves up and down as it turns. Below, sanding a beveled angular cut on a disk sander



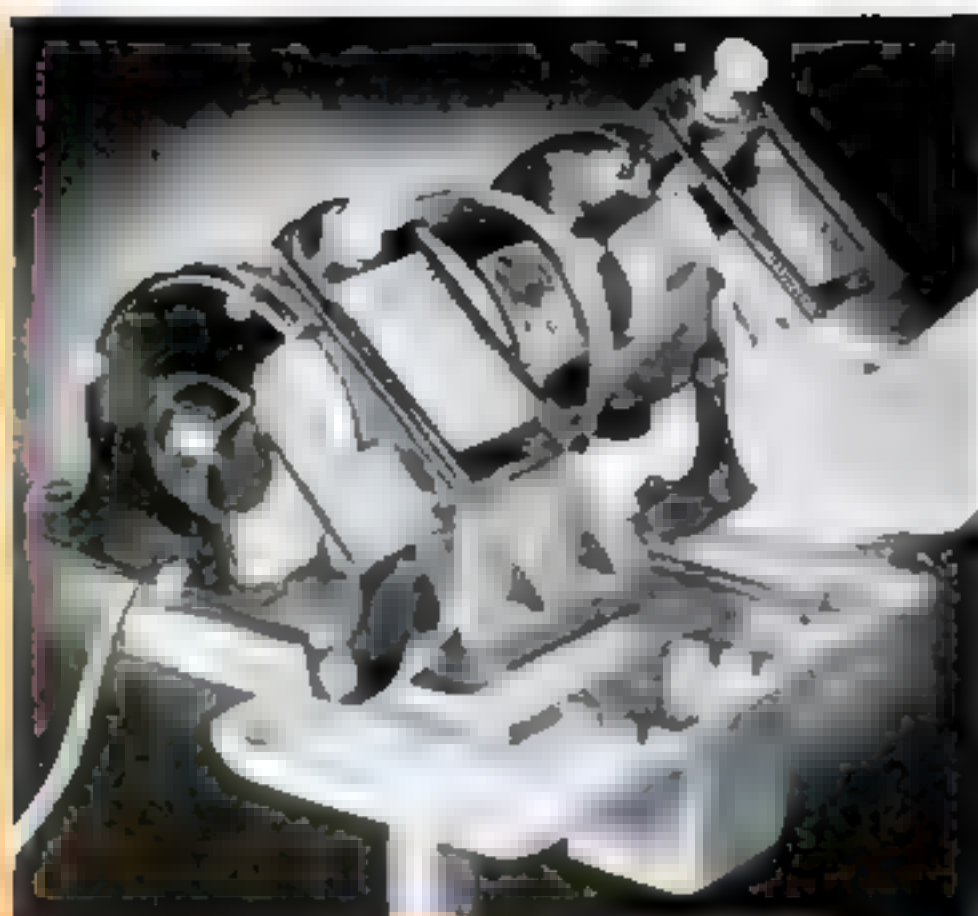
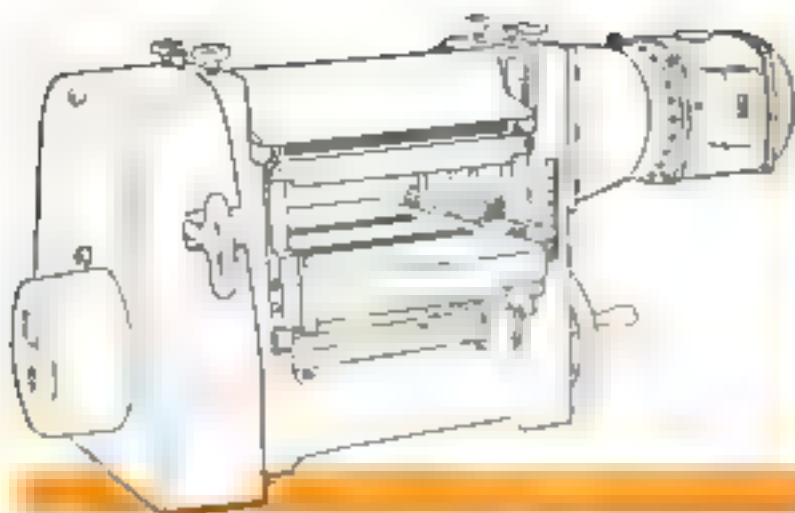
an arbor at each end, and needs only to be cranked out of the quill and inserted with the proper end up. This gives freedom from vibration at the high speeds used—7,000 r.p.m. or more. The cutter is clamped on the arbor with a nut and keyed washer.

How are adjustments made?

Depth collars below or above the cutter roughly adjust for height. Finer adjustment is obtained with a worm-wheel turning on a threaded upright rod, or some such device, or by a handle fitted with a cone that slides in a helical slot having tapered sides, so that backlash is eliminated. Clamps lock the spindle in position.

What drives are used?

A V-belt drive with high-speed motor is common, but gears, protected from shock by a clutch, are also used. Belt tension is usually adjusted by shifting the motor a little.



Upper left, a bench thickness planer. Left, a wet grinder for tool dressing. Above, a good tool grinder. Below, cut-away view of repulsion motor.

Is a disk or a belt sander better for average use?

It depends. The disk is less expensive, and well suited to accurate small work, such as fitting joints, smoothing outside curves, shaping blocks. The belt sander smooths with the grain. Equipped with a sliding table, it will sand a board that is both wide and long; and if properly mounted, will permit a cabinet or table to be placed underneath for smoothing.

What is a spindle sander?

It is sander with a tilting table, using vertical drums of various sizes. The spindle not only turns, but also moves up and down, thus preventing scoring. As the work is supported by the table, it is easily guided.

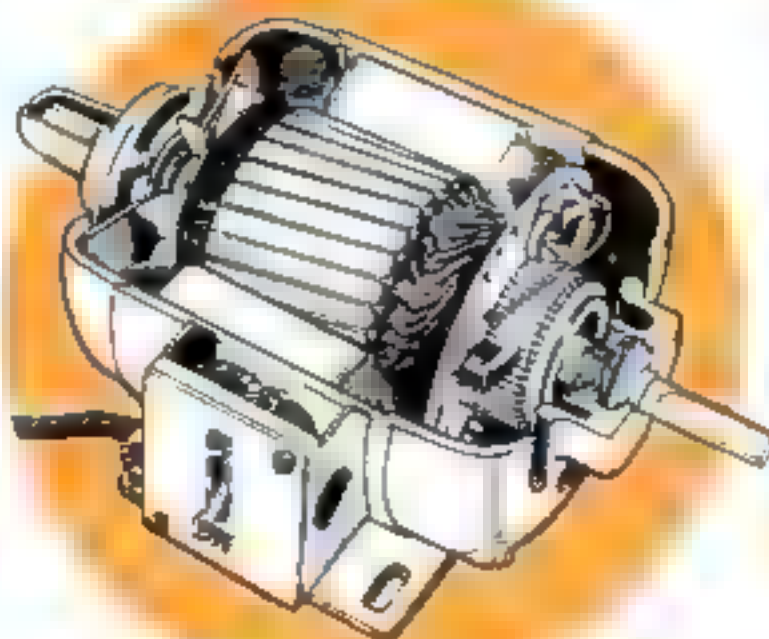
Is there any advantage in owning a bench planer?

If you have one of these machines, rough lumber can be purchased at a saving in cost and dressed to size at home, so that few sizes need to be stocked. They are machines equipped with cutter heads similar to jointers, with power feed, and are used to plane boards and reduce them to any desired thickness. They

will handle stock of about these sizes: Up to 12" wide and 4" thick, down to 1/16" thick, and as short as 6 1/2". While these machines usually require from 1 1/2 to 2 h.p. motors, many home shops have installed them.

How are modern home-workshop grinders built?

They are equipped with ball bearings and balanced abrasive wheels inclosed with heavy guards and shielded with windows that protect the user's eyes from flying particles. Adjustable tool holders, and trays with wells for cooling water, are common. For tool grinding there is the so-called "wet grinder," geared to a rather low speed and running in water, thereby protecting tools being ground from temper-drawing heat.



Why are different kinds of motors used on home shop machines?

The motors must meet the kind of service demanded, and operate on the power source at hand, usually ordinary house current. Most homes have alternating current (A. C.) at 115 volts, though farms with home lighting plants may use direct current (D. C.) at 32 volts. A 32-volt motor

Where Our Budget Shop Stands After Eight Months

Robert Jaacks, who is assembling our \$15-a-month budget shop, is still paying for his circular saw, jointer, and scroll saw, as well as for the excellent used motors he obtained on time from a dealer close to home. He is adding a few accessories to his machines, and at the same time is saving toward a down-payment on a good wood-turning lathe. To date, besides the machines and his assortment of hand tools, he has a dado head for the circular saw. Next month he intends to buy an extension for his saw table.

would burn out on a 115-volt circuit. An A. C. motor will not run on D. C., and vice versa, except for the so-called "universal" motor, which is a series-wound D. C. machine. It races at no load and slows way down on heavy loads, making it of little value for use with woodworking machines.

What motors are suitable for the home workshop?

D. C. motors usually run at 1,750 r.p.m. and slow down but slightly under load. The least expensive A. C. motor is the split-phase. It has an extra winding of fine wire that is automatically disconnected by a governor when the motor comes up to speed. (Single-phase motors are not self-starting without an extra device.) Unfortunately, it draws a heavy starting current and has a low starting torque, so it cannot be used for machines that start under load. Some lighting companies prohibit the use of this type.

Capacitor motors use heavier starting

windings in series with an outside condenser, and have good starting torque with moderate current demand.

A repulsion motor has a wound armature, a commutator, and brushes. After starting, the commutator automatically short-circuits and in some cases the brushes lift. Little starting current is required, and a powerful starting torque is developed. This motor, in spite of its slightly higher cost, should be chosen for heavy duty.

Three-phase motors are the most rugged of all, but barred to most home shops because three-phase current is not available.

Good motors will deliver twice or more the rated horsepower before stalling. Most are reversible, either by interchanging certain leads or with a switch.

Sleeve or bushing bearings on motors are lubricated by wicks dipping in oil reservoirs, or by rings that revolve on the journals and carry oil up. Ball bearings have sealed-in lubrication and should be used for all vertical installations.

As speed depends on cycles in A.C. motors, always specify the number of cycles so that the proper motor and pulleys or gears to suit will be supplied.

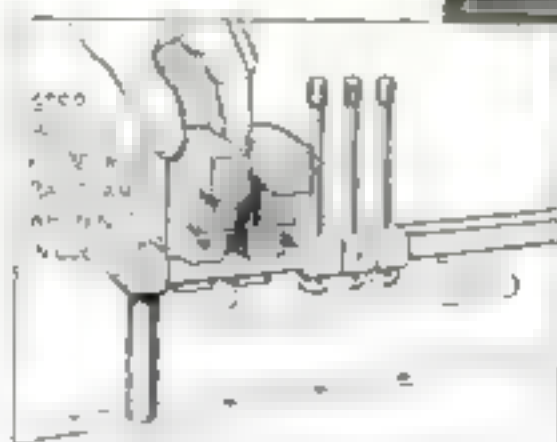
(TO BE CONTINUED)

Beads Turned on Spindles with Old Plane Cutters

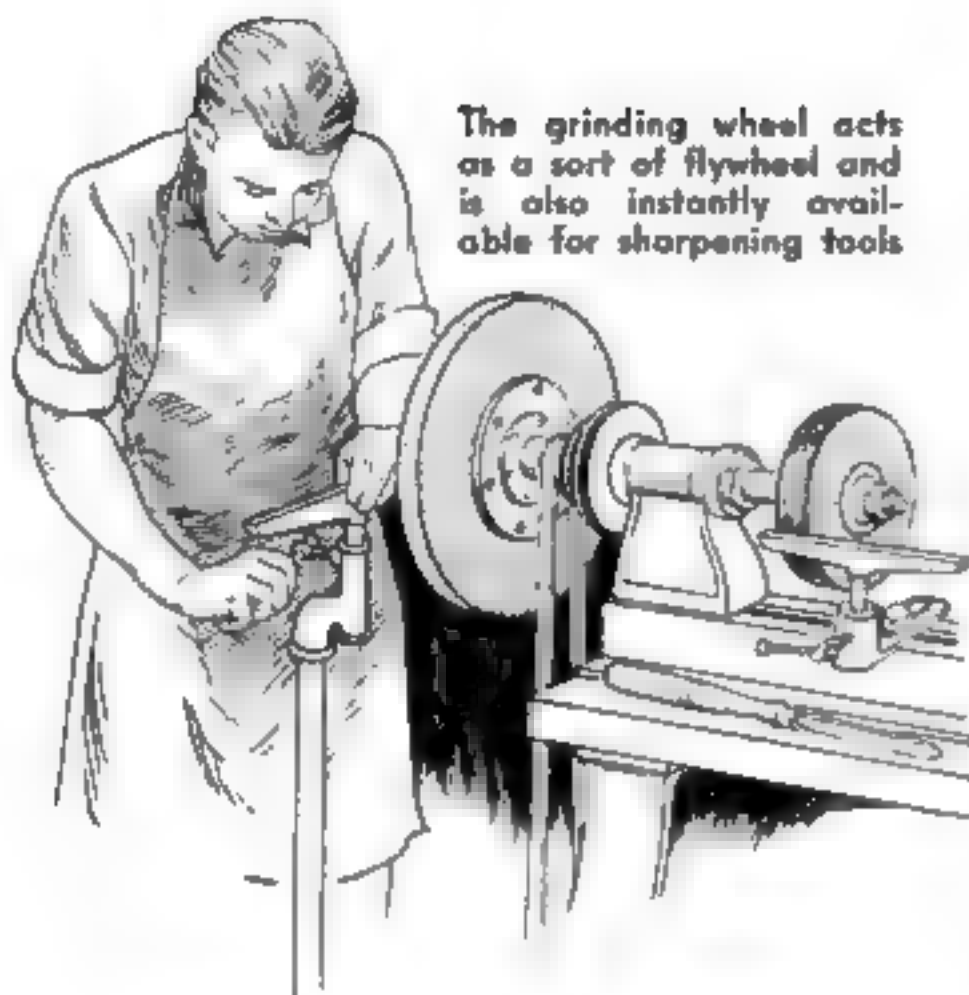
TO SAVE time in turning ornamental beads on small wooden spindles, I use multiple cutters made from the beading cutters of an old combination molding plane. The plane is one I have not used since I installed a circular saw and spindle shaper. The cutters were carefully sharpened, and I had tangs spot-welded to them at trifling cost so handles could be attached.—M. A. CARTY.

Step Blocks Aid in Using Miter-Gauge Clamp

IN USING a miter-gauge clamp attachment on a circular saw, it seems as if the clamp screws are never in the position where they are needed and must be screwed up or down to suit the work. This process takes considerable time when the clamp is used much, but a set of step blocks made as shown will remedy this difficulty. The most convenient step is slipped under the end of each clamp screw, and the screw is tightened. When not in use, they are placed between the clamp bars.—H. R. H.



When a miter-gauge clamp attachment is used for various thicknesses of wood, it saves time to make step blocks. These can be kept between the bars as at left



The grinding wheel acts as a sort of flywheel and is also instantly available for sharpening tools

Grinding Wheel Balances Large Turned Work

IN TURNING large diameter pieces mounted on the outer end of your wood-turning lathe spindle, you will find it helpful to mount a grinding wheel on the grinding arbor as shown. It balances to a certain degree the weight of the work and acts as a flywheel, thus insuring smoother running. At the same time, the grinding wheel is convenient for sharpening the tools, which wear rapidly when used on such large work. They can be sharpened simply by moving around in front of the lathe, and without stopping it.—H. S. THOENESE.

Setting Posts in Concrete

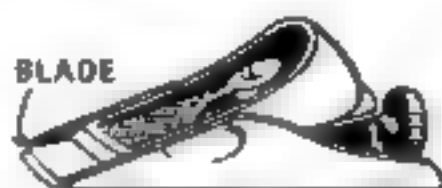
IF YOU have to anchor wooden posts in wet cement, thoroughly saturate the ends beforehand with linseed oil and allow the wood time to expand. This prevents cracking the cement and retards rotting.

New Use for Block Plane

A BLOCK plane discarded because of a damaged nose may again see service as a cabinet-maker's chisel plane. The broken nose is cut off and ground smooth as shown. A home-shop worker whose budget has not permitted him to buy a chisel plane can obtain one in this way. If he does not have a damaged plane, he might purchase a new cheap one.—X. S.



CUT ALONG LINE AT THROAT

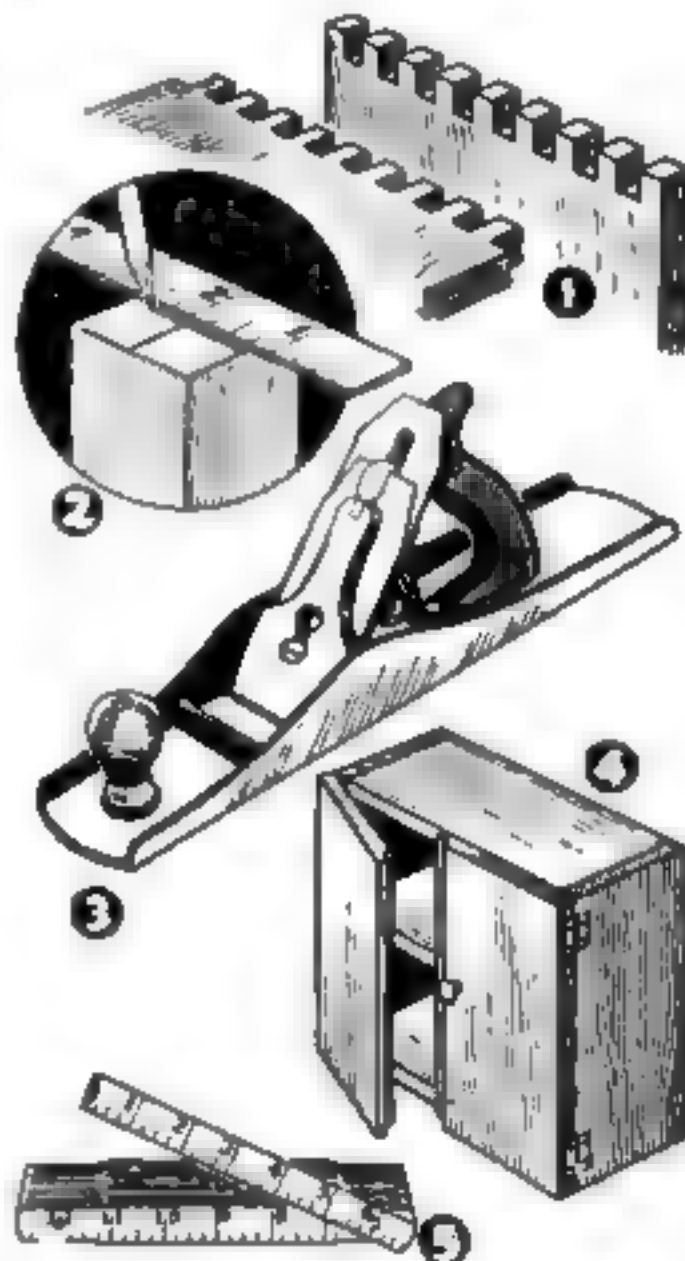


CHISEL PLANE

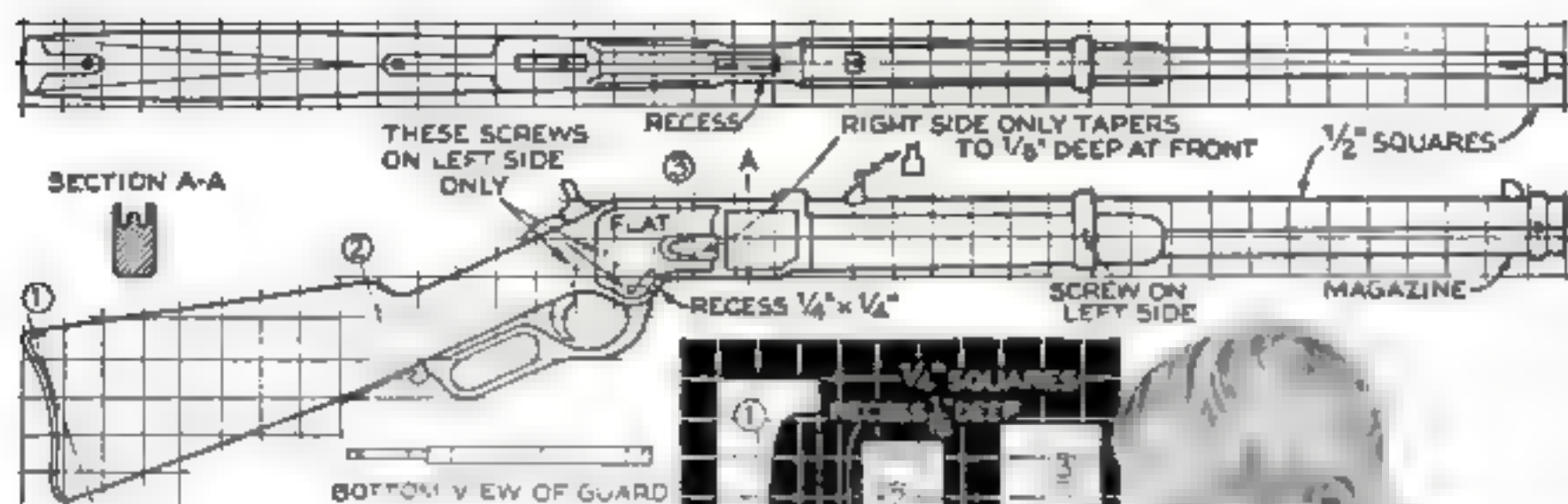
What's Wrong? IN THESE SKETCHES?

EACH of the five drawings below shows one rather conspicuous error. Can you spot them? The answers are given below, but they are printed upside down so it will be easier for you to avoid reading them before you try to detect the mistakes yourself.

In Fig. 1 is shown a box joint, and in Fig. 2 a method of locating a center on the end of a square piece of stock to be turned. Figure 3 is a jack plane. A simple method of cupboard construction is illustrated in Fig. 4. An ordinary folding rule appears in Fig. 5—or is it?



1. Assembly is impossible because the number of tenons does not match the slots. 2. Not an accurate method; diagonal lines would be better. 3. The slot in the blade cap should be below the screw to permit easy insertion of the cap. 4. The rabbeting should be reversed, otherwise the doors would not open properly. 5. The numerals 8, 9, 10, 11, and 12 will read upside down when the rule is opened.



Whittled MODEL OF EARLY Winchester Repeater

FOR those who like to whittle wooden models of famous firearms, here are drawings of a half-size model of one of the first Winchester repeaters.

This gun was patented October 16, 1860, and manufactured in New Haven, Conn.

The model can be jig-sawed and carved from a piece of white pine 1" by 4" by 19 1/2". First shape the barrel and magazine, next

the underside of the stock, and then the stock butt. Leave the trigger guard and hammer to the last. Keep the model in the natural wood or stain the wood parts walnut and paint the metal parts gun metal.

Shelf Sawed from a Chopping Bowl

A MAPLE chopping bowl is cut in half to make this attractive shelf. The design is jig-sawed as shown, and the top part is cut to shape from a piece of thin board and attached with thin screws. Near the back edge two 3/16" holes are drilled. After sanding the wood, apply two coats of shellac. The shelf is then hung over two L-shaped screw hooks placed in the wall at a convenient height. —BENJAMIN NIELSEN.



After the bowl has been sawed in half, the openings are scroll-sawed and a board is fitted in to fill out the top



Yardstick with Handle Is Easier to Use

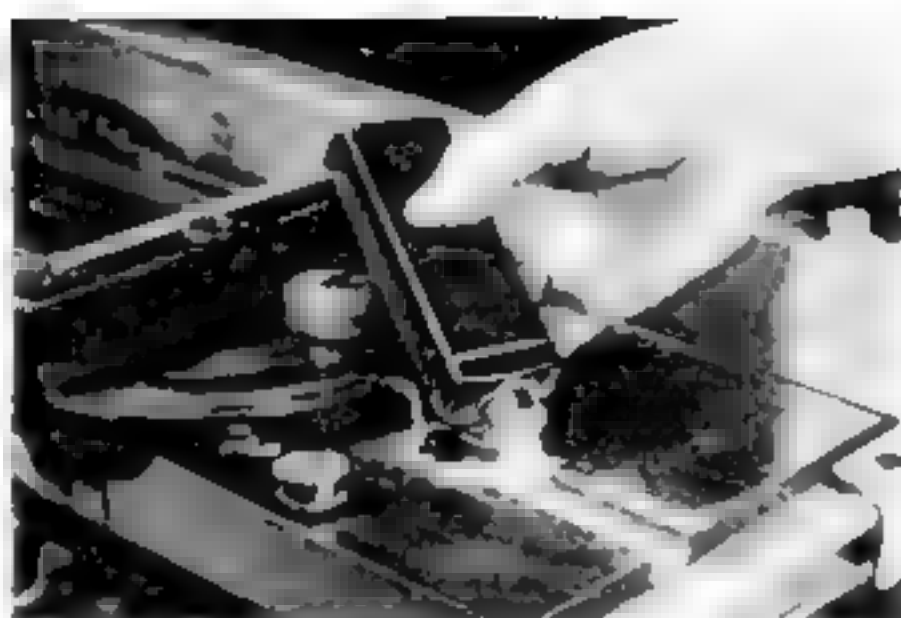
THE addition of a small wooden block to an ordinary yardstick will make it handier to use, especially for blackboard diagrams. The block, about 2" by 4", should be attached so the ends will be at right angles to the yardstick. Mathematics instructors will find this hand grip helpful in drawing and scaling coordinate axes and graphs. If you do not have a need for drawing right-angle lines, a cheap metal drawer pull will serve as the handle.—A. C. FLACKBERT



Geometric diagrams are easily drawn when a handle is added

Notched Kitchen Knife Cuts Small Weeds

MANY home gardeners and nurserymen find it difficult to keep weeds from their seed flats and young plants. An efficient weeding tool can be made by notching an ordinary kitchen knife as shown. To do this, I used a back saw. Any weeds not cut by the knife will catch in the notches and be pulled out by the roots.—JACK MCKINNEY.



Miter-Gauge Slide Kept Working Smoothly

WHEN oil or other ordinary lubricant is used to coat the track of a miter gauge on a saw or other machine tool, it will gum up and cause sticking within a short time. This can be prevented by using talcum powder, which allows the gauge to move almost as easily as if it were on roller bearings. The talcum will not mark any work with which it comes in contact.

Kitchen Vegetable Bin Built of Thin Wood

THIS kitchen vegetable bin holds a quantity of potatoes and other vegetables. The first one I made was constructed of $\frac{1}{4}$ " hardwood crating material picked up at an appliance store, but any thin, strong material may be used.

Note that the 4" wide top front strip is nailed inside the corner posts. The wall of the bin slopes down, and this allows for a third compartment. To provide ventilation, a few $\frac{1}{4}$ " or $\frac{3}{8}$ " holes should be bored in the bottom.—P. E. FALLON



Plywood, pressed composition wood, or crating material may be used

CUT AWAY TO SHOW SLOPE OF UPPER BIN

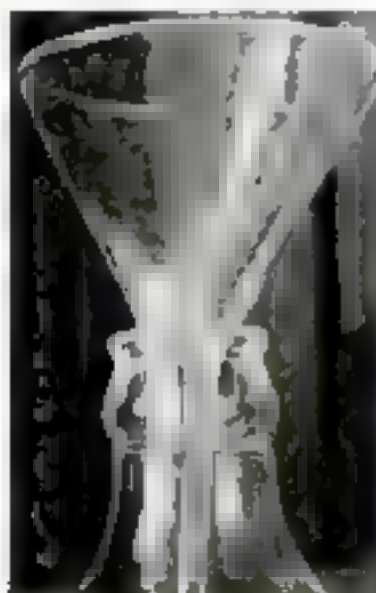


Engraved Marks Colored for Easy Reading

FIGURES, letters, and lines engraved or stamped into camera lens mounts, optical instrument cases, workshop tools such as steel squares and scales, or other objects, can be made easy to see simply by applying white oil paint or lacquer. Wipe off the excess by rubbing the surface on a piece of hard cloth laid flat. For highly-polished metal, aluminum, and other light-colored surfaces, you can use black or other dark-colored paint.—W. E. B.

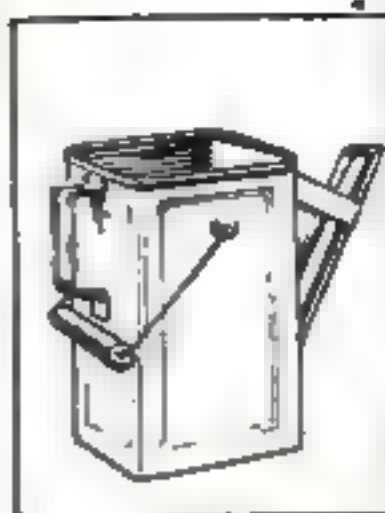
Removing Water from Alcohol

DENATURED alcohol which is used to thin shellac and for other purposes, should be as free from water as possible for best results. Ordinary commercial alcohol, however, contains a small percentage of water. To remove it, add a little pure, granulated hide glue. This will absorb the water, but will not affect the alcohol. If desired, the glue may be suspended inside a cloth sack.



Tape Protects Glass Funnel

A FEW thin strips of waterproof adhesive tape placed on a funnel where it touches the bottle will protect the funnel and hasten the rate of pouring by allowing more space for the air to escape.



Watering Can and Pail Obtained at No Cost

WATERING cans or pails can be made from the 2-gal. cans in which motor oil is frequently sold. Remove the top with a can opener and add a bail of heavy wire that has been slipped through a hole in a piece of broomstick. The holes in the can through which the bail passes must be reinforced by soldering on washers. A length of discarded tubing may be used as the spout, and the handle that was originally on top of the can is removed and soldered to the back. Paint the can if desired.—WESLEY O. WALKER.

Countersink Reams Pipe Bowl

IT TAKES only a few seconds to ream out a thickly caked pipe bowl with a brace and a $\frac{3}{8}$ " rose countersink of the type commonly used for screw holes, as illustrated at the right.

Since the standard bore of pipe bowls is $\frac{3}{8}$ ", the use of a $\frac{3}{8}$ " reamer restores the bowl's maximum capacity while leaving a safe thickness of cake to insure good smoking, and the operation will not injure the pipe.—J. M.

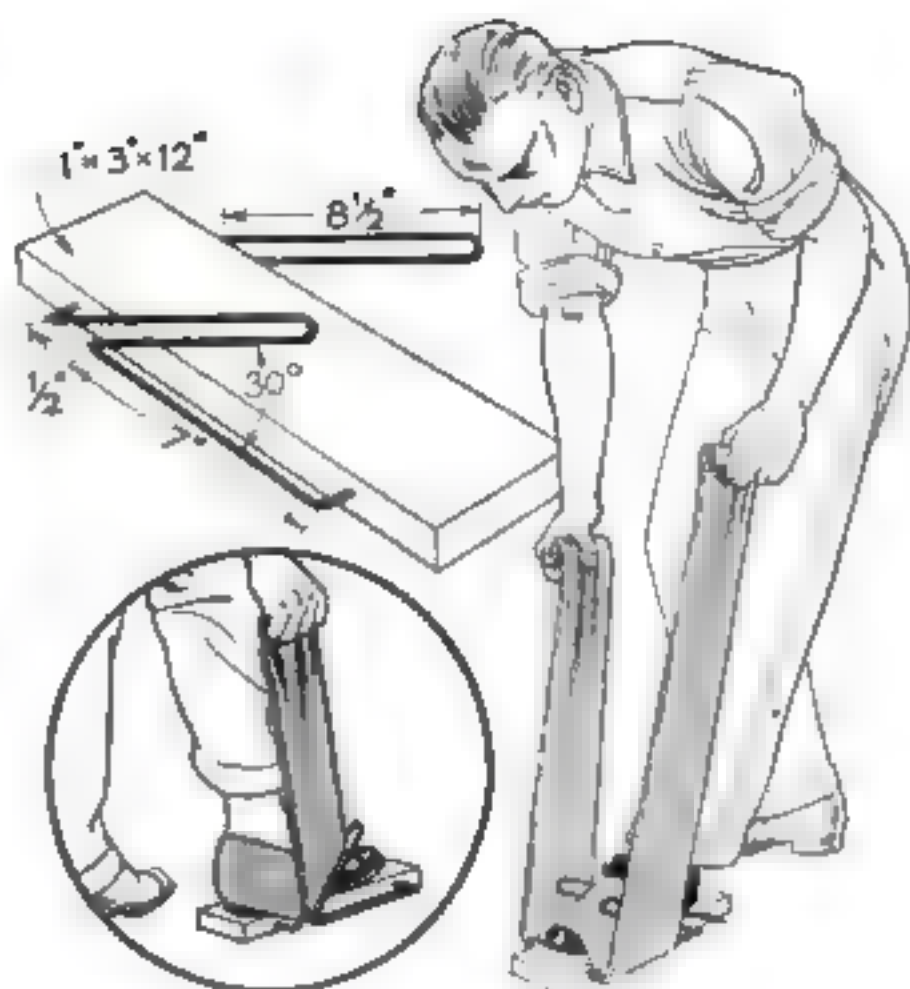
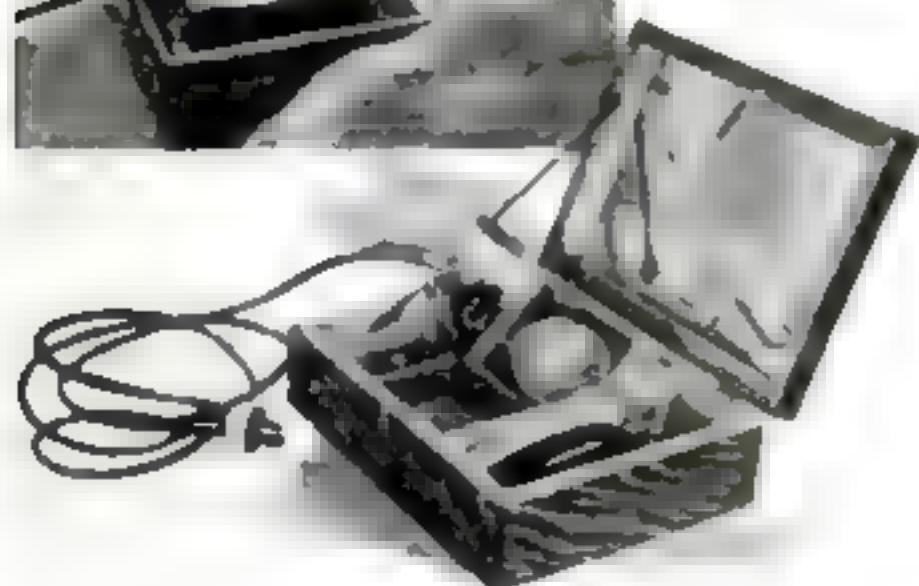


Shaving Box Has Mirror, Lamp, and Outlet

ELECTRIC shavers are frequently used in other rooms than the bathroom and sometimes away from home in the office or shop, where there never seems to be an available outlet close to the light. In such cases a shaving box made like the one illustrated is a great aid. It has a receptacle into which the shaver can be plugged, and a long extension cord which can be plugged into any convenient outlet in the room. The tilting reflector is formed from a tin can of suitable size, which pivots on a screw through the end.—R. O. LISSAMAN.



The electric shaver plugs into an outlet in the box, and a longer cord is run from the box to any convenient outlet



Shoe-Polishing Stand Insures Good Shine

A **SHOE** shine that equals in brilliance the ones given by an expert bootblack can be obtained at home with the device shown. Two $\frac{1}{4}$ " cold-rolled steel rods 27" long and a 1" hard pine board 3" by 12" are the only materials needed. Bore two $\frac{1}{4}$ " holes through the board $1\frac{1}{2}$ " from each end. Bend the rods as shown (one right-hand and the other left-hand) and force them in from each side, leaving about $\frac{1}{2}$ " clearance for the polishing cloth.—WILLIAM A. SPELLMAN.

LITHARGE-GLYCERIN CEMENT

[FORMULAS]

Properties. Extremely hard, resistant to heat and dilute acids, sets quickly.

Uses. Forming water-tight connections between iron pipes and porcelain fittings, cementing glass aquariums, filling in indentations on metal surfaces to be given a glossy finish, lining digesters and sulphite liquor tanks, cementing bricks and tile.

Preparation. To six parts of pure commercial glycerin and from one to three parts of water, add sufficient finely ground litharge (PbO) to form paste of the desired consistency. Mix only as much as can be used immediately. (Variations in water influences time of setting and general characteristics to some extent.) The cement sets in ten minutes, but this may be retarded by adding not more than ten percent inert matter such as silica, Fuller's earth, or iron oxide. These do not have any appreciable effect on the ultimate hardness or strength.

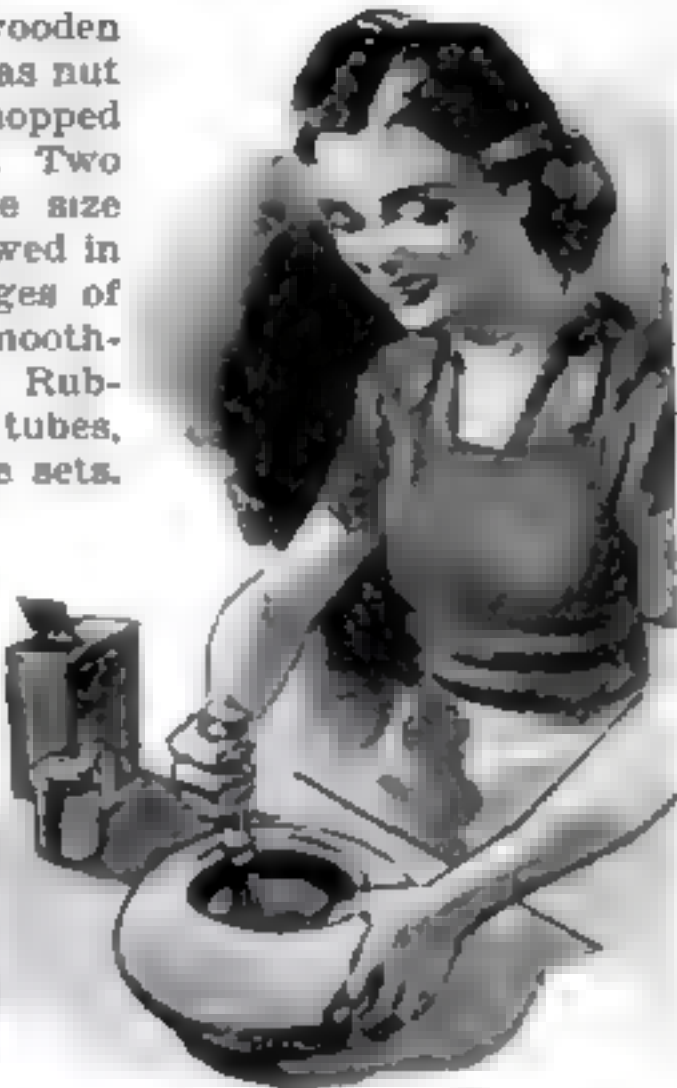
POPULAR SCIENCE MONTHLY SHOP DATA FILE

Rim on Chopping Bowl Prevents Spilling Contents



A hole is jig-sawed in the bottom of one chopping bowl, which is then glued on the second bowl and held with bands of rubber

IN THIS double-decker wooden bowl, dry ingredients such as nut meats and popcorn may be chopped without particles flying out. Two chopping bowls of the same size are used, and a hole is jig-sawed in the bottom of one. The edges of both bowls are sanded to fit smoothly and then glued together. Rubber bands, cut from inner tubes, hold the bowls until the glue sets.



Universal Clamp for Flash Light

A HANDY flash-light holder can be made from a standard clamp-on device with ball-and-socket joint sold for attaching a photoflood lamp to any object.



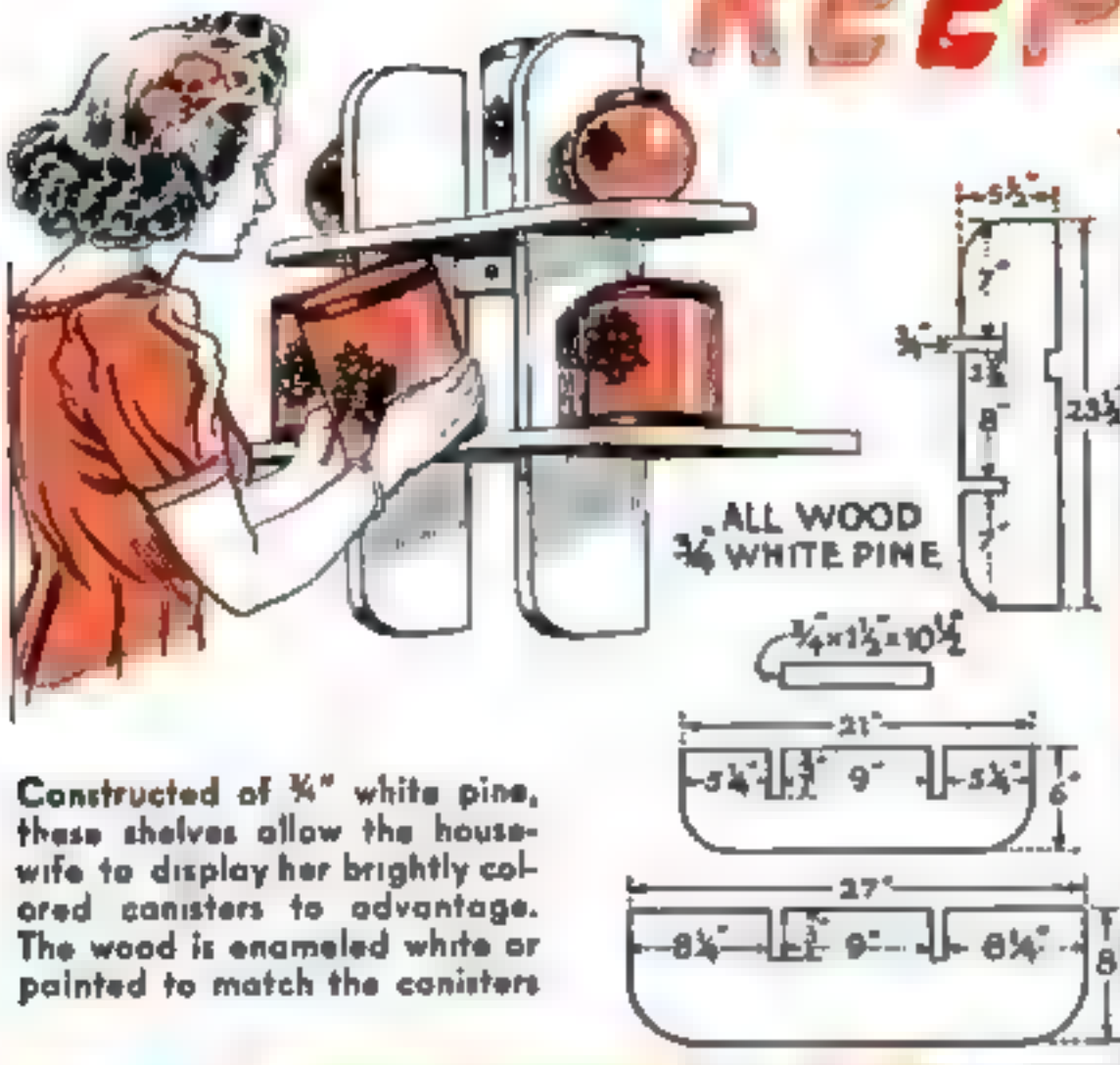
Brushes Cleaned in Bottle Caps

THE protective paper caps that come on milk bottles can be used to advantage for cleaning paint-brushes or small mechanical parts, and for similar jobs that require only a small amount of cleaning fluid.

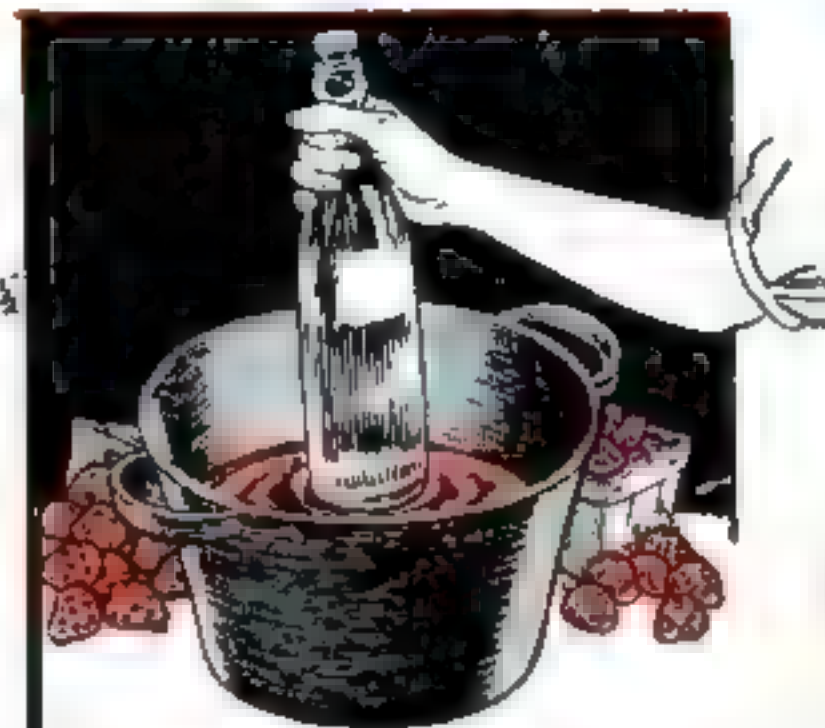
DECIMAL EQUIVALENTS [CALCULATIONS]

| Fraction of Inch | Decimal | Fraction of Inch | Decimal |
|------------------|---------|------------------|---------|
| 1/64 | .015625 | 1/8 | .125 |
| 1/32 | .03125 | 9/64 | .140625 |
| 3/64 | .046875 | 5/32 | .15625 |
| 1/16 | .0625 | 11/64 | .171875 |
| 5/64 | .078125 | 3/16 | .1875 |
| 3/32 | .09375 | 13/64 | .203125 |
| 7/64 | .109375 | 7/32 | .21875 |
| 1/8 | .125 | 15/64 | .234375 |
| 9/64 | .140625 | 1/4 | .25 |
| 5/32 | .15625 | 17/64 | .265625 |
| 11/64 | .171875 | 9/32 | .28125 |
| 3/16 | .1875 | 19/64 | .296875 |
| 13/64 | .203125 | 5/16 | .3125 |
| 7/32 | .21875 | 21/64 | .328125 |
| 15/64 | .234375 | 11/32 | .34375 |
| 1/4 | .25 | 23/64 | .359375 |
| 17/64 | .265625 | 3/8 | .375 |
| 9/32 | .28125 | 25/64 | .390625 |
| 19/64 | .296875 | 13/32 | .40625 |
| 5/16 | .3125 | 27/64 | .421875 |
| 21/64 | .328125 | 7/16 | .4375 |
| 11/32 | .34375 | 29/64 | .453125 |
| 23/64 | .359375 | 15/32 | .46875 |
| 3/8 | .375 | 31/64 | .484375 |
| 25/64 | .390625 | 1/2 | .5 |
| 13/32 | .40625 | | |
| 27/64 | .421875 | | |
| 7/16 | .4375 | | |
| 29/64 | .453125 | | |
| 15/32 | .46875 | | |
| 31/64 | .484375 | | |
| 1/2 | .5 | | |

KEEPING THE



Constructed of $\frac{3}{4}$ " white pine, these shelves allow the housewife to display her brightly colored canisters to advantage. The wood is enameled white or painted to match the canisters



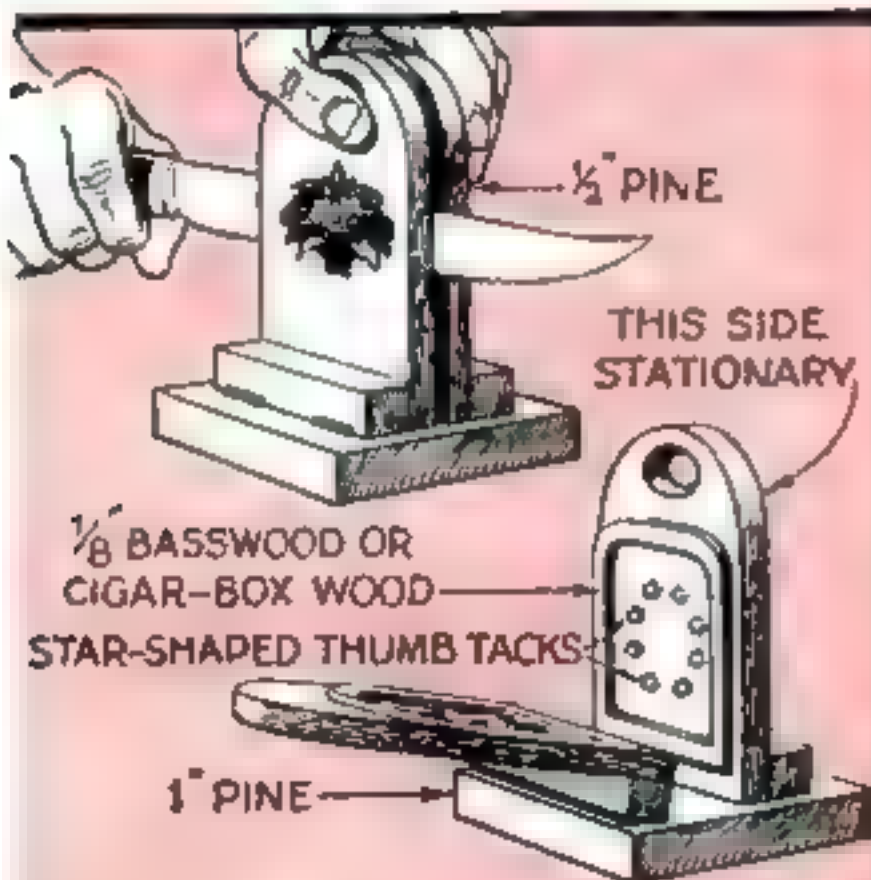
A long-necked glass bottle makes an excellent fruit crusher. It may be filled with water for added weight



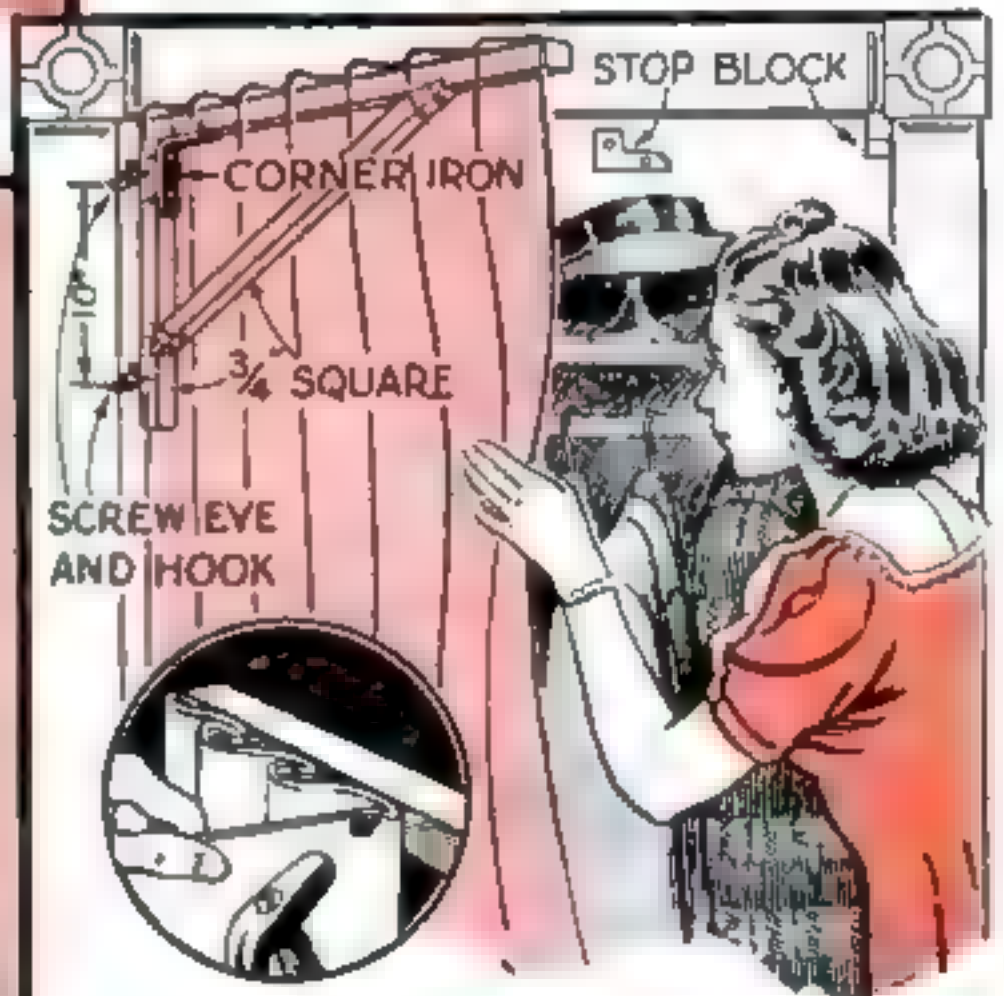
Cheesecloth held between embroidery hoops protects food from dust and flies while cooling



Thread and lint may be removed from a vacuum-sweeper brush with the frame of a safety razor

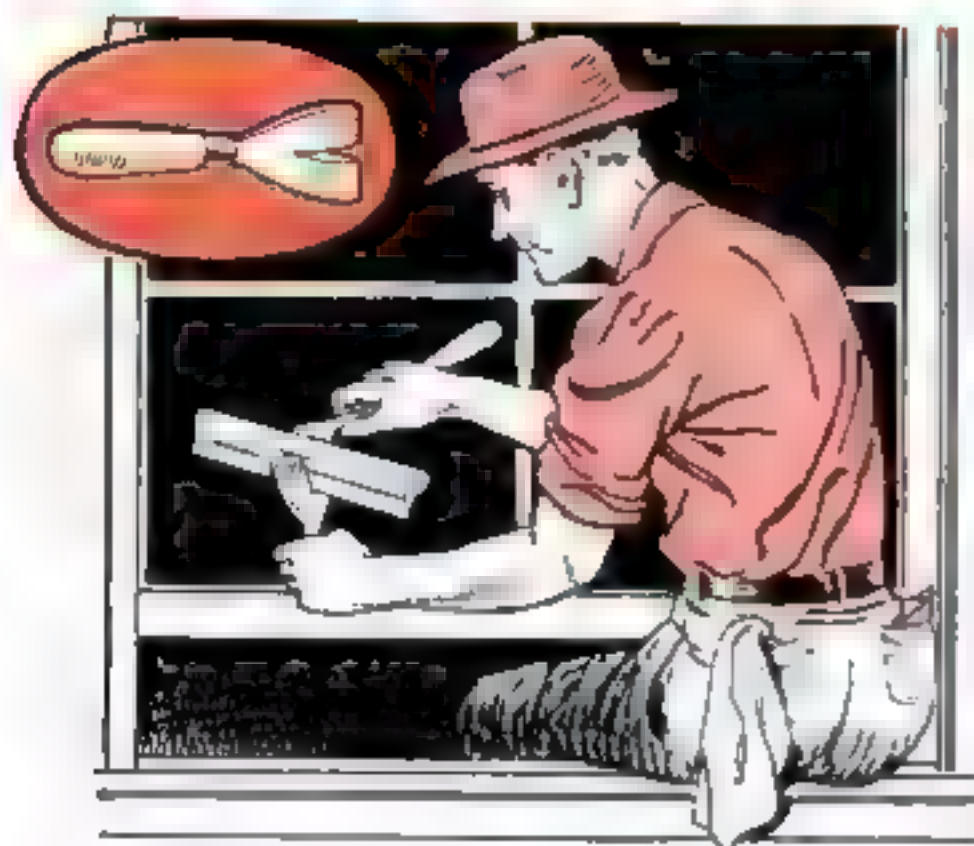


When closed, this household gadget holds a regular slice of bread so it may be sliced in two with a sharp knife for Melba toast



Here is a convenient way to hang a curtain in a closet doorway. The bracket swings like a door. Pleat the curtain so that the tacks won't show

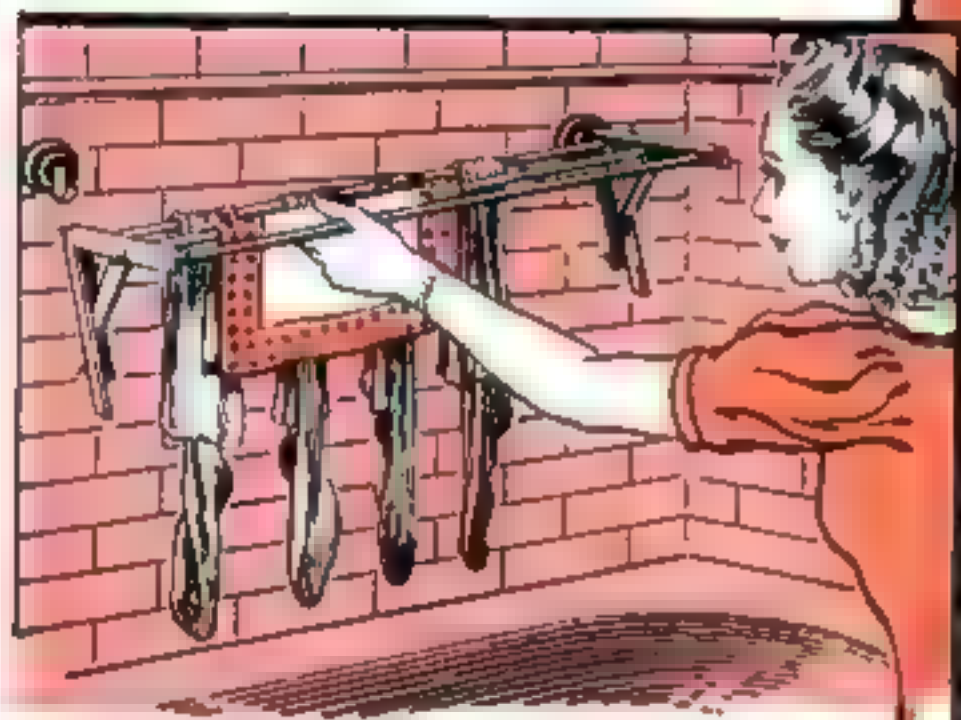
HOME SHIPSHAPE



Instead of using a cloth to clean a window wiper, cut a narrow notch in a rubber plate scraper and strip the water from the blade



When repairing the roof with tar or roofing cement, a substitute for a brush may be made by folding burlap and then tying it to a hoe blade



To make this aluminum drying rack, rivet $\frac{3}{4}$ " tubing to $\frac{1}{2}$ " angle brackets. Moisten hook vacuum cups with glycerin to give a better seal



Sandpaper placed over the table edge as shown will keep the food chopper from working loose



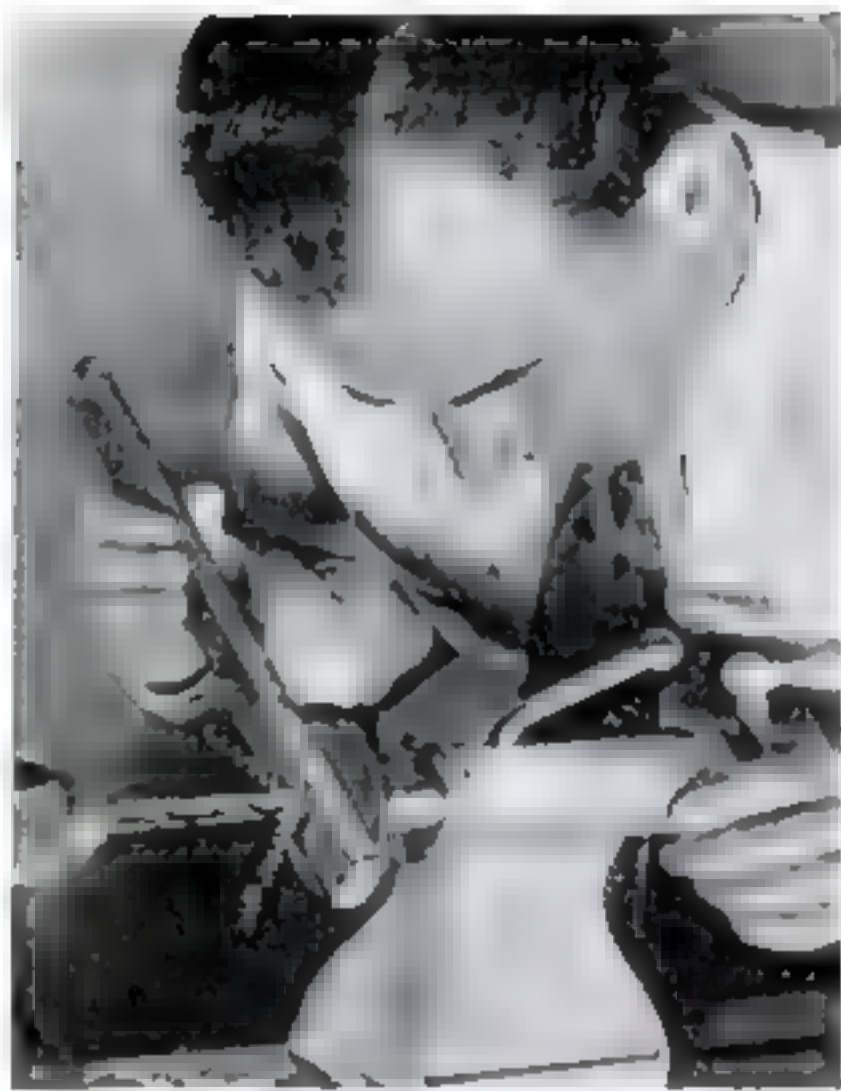
An ordinary wire coat hanger can be bent over and back to form a handy holder for the garden hose. Bend the hook to grip the hose firmly



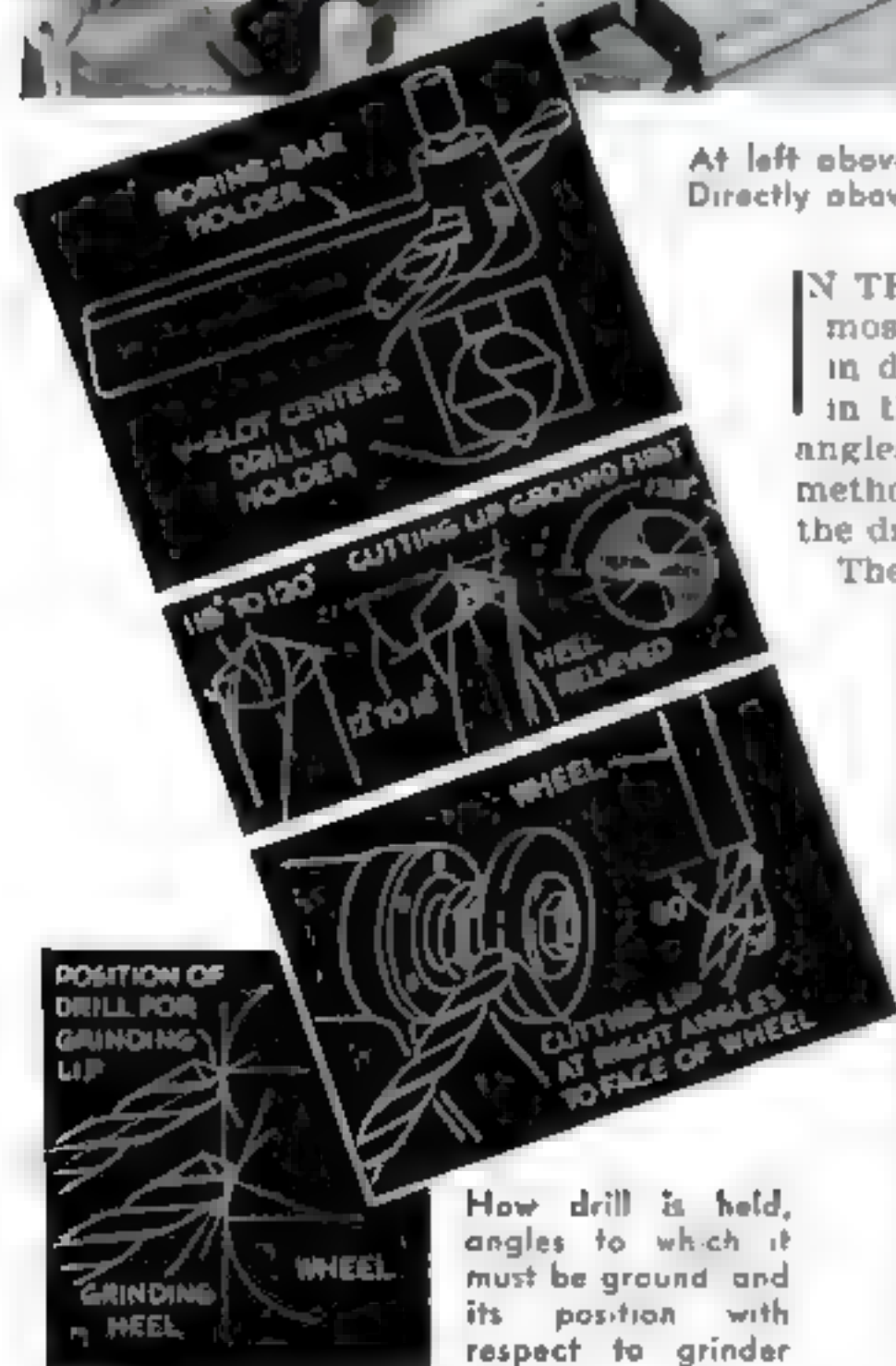
The enjoyment of eating outdoors is simplified by hinging a shelf level with a window opening on the porch. The table is set through the window, and thus saves the housewife many steps

NEW SHOP IDEAS

Sharpening Small Drills



At left above, setting swivel of lathe rest to correct angle. Directly above, a correctly ground drill produces two spirals



IN THE small shop and the home workshop, the most used metal-cutting drills are less than $\frac{1}{2}$ " in diameter. These are difficult to sharpen, and in the very small sizes it is hard to judge the angles. If, however, a metal lathe is available, the method illustrated will enable anyone to sharpen the drills so that they cut like new.

The grinding wheel should be about 3" in diameter and of a fine grit. The holder for the drill is a small boring-bar holder or a combination tool bit and boring-bar holder. Some sort of stop is needed for the back end of the drill, and a simple one may be made from a small rod as shown in the photograph at the top of the next page. The stop rod assures cutting lips of equal length.

The swivel of the slide rest is swung to the 30-deg. angle for the lip of the drill. The drill in the holder is adjusted to a position parallel to the side of the wheel, and the stop rod is placed against the shank of the drill. Next, the swivel is returned to its original position and secured. The lip of the drill to be ground is adjusted level, and the angle for the lip clearance is adjusted—12 to 15 deg. The lip of the drill is then passed across the face of the wheel, after which the other lip

How drill is held, angles to which it must be ground and its position with respect to grinder



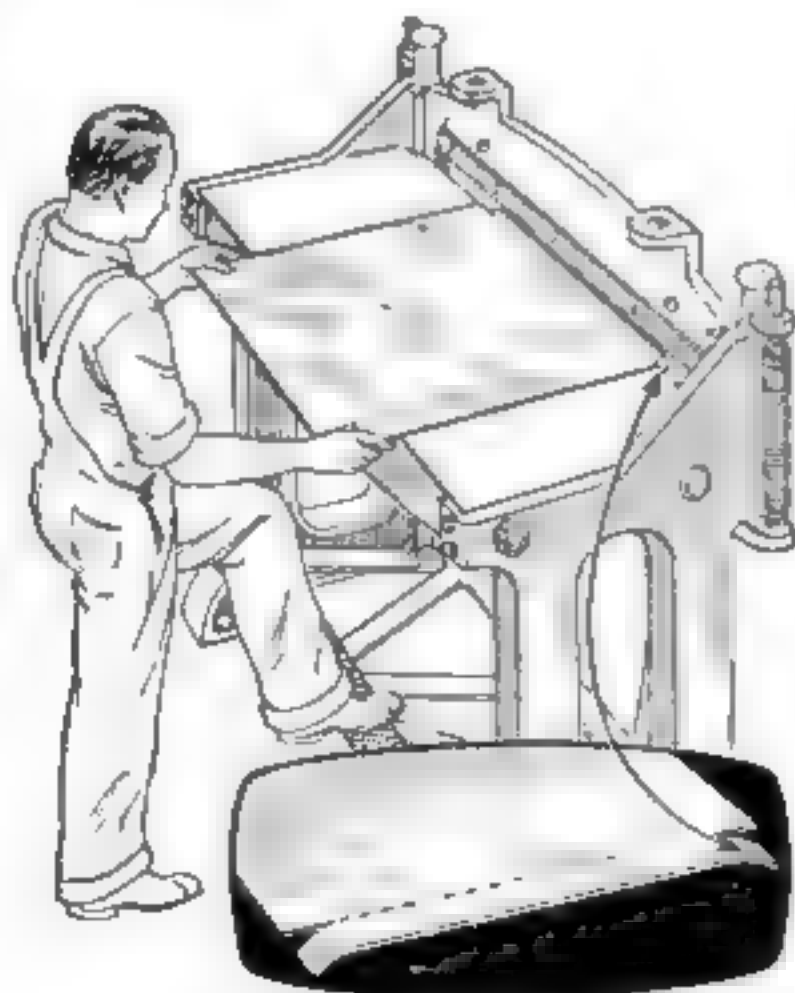
is moved into position and moved back across the wheel. This will give two lips of the same angle and the same length.

The heel of the point of the drill is ground in a similar operation. The holder for the drill is raised so that the drill cuts higher on the wheel, and the heel of the point is relieved slightly to provide the necessary clearance. As the drill is not rotated as it is ground, this relieving process is necessary to prevent the back of the lip from dragging.

A drill which has been correctly ground as described will produce two spiral chips when boring into metal, as shown on the preceding page.—HOWARD R. HEYDORF.

Tabs Line Up Sheet Metal in Shearing Machine

WHEN sheet metal is cut in a square shear, the problem of properly lining up the trim line with the lower cutting edge of the shear can be simplified by first shearing a little of each end of the sheet with tin snips or an open bench shear and bending down the ends as shown below. The sheet is then inserted in the shear, and the bent tabs are pulled against the stationary shear blade. This will accurately line up the trim line. In addition, the method can be used for cutting sheets square without the necessity of setting up a squaring plate on the table of the shearing machine before starting operations.—F. P.

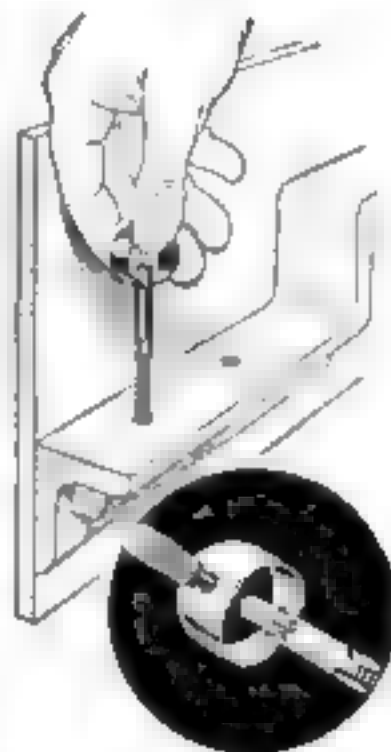


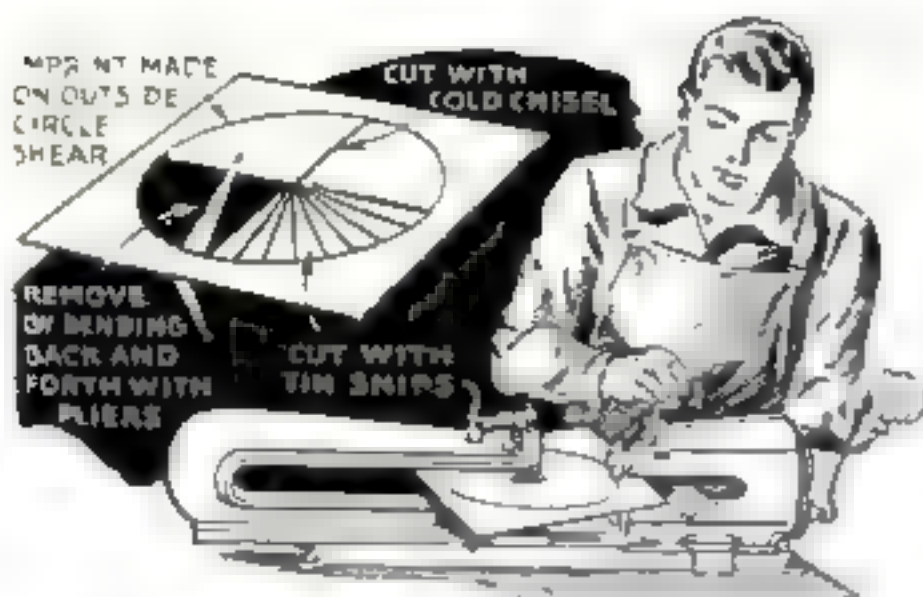
Spectacle Case Used as Kit for Very Small Tools

OLD snap-lid spectacle cases are handy receptacles for small drills, taps, gauges, and the like, which are often lost among the larger tools in a mechanic's kit.—J. H. D.

Cleaning Out Tapped Holes

THE bow spring of a pair of discarded dividers can be used as a small tap wrench in many places where there is not room for the usual wrench. This is often the case in repair work where a tap has to be used to clean out threaded holes that are full of dirt. The ends of the spring have a slotted opening, originally for the divider legs, and these will firmly pinch the corners of most small hand taps. Remove the knurled finger stem at the top of the bow if it is in the way of the work.—FRANK BENTLEY.

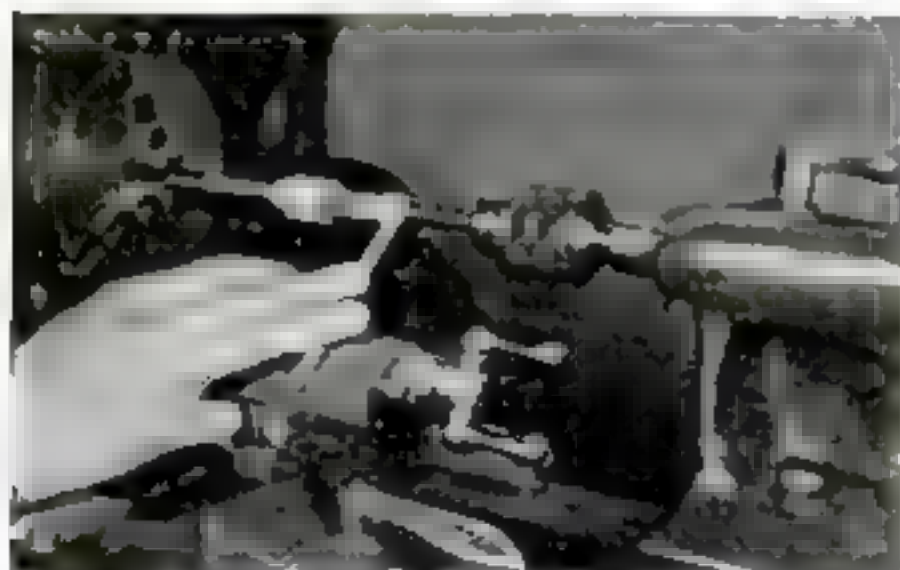




Cutting Large Holes in Sheet Metal

WHEN a number of large round holes have to be cut in heavy sheet metal and no inside circle-cutting shear is available, it can be done with the ordinary outside-circle cutting shear. The shear is adjusted to the proper circle, and the metal is placed between centers as usual. The cutter wheels are then turned rapidly, and at the same time they are gradually brought together so as to make a heavy imprint without cutting through. This is important because if the metal is cut through, it will buckle.

After the imprint is made, the metal is removed and two lines are struck across the inside of the circle with a chisel. Cuts are then made with tin snips as shown, and the triangular pieces are broken out by bending them back and forth a number of times with pliers.—JOSEPH TICHY.



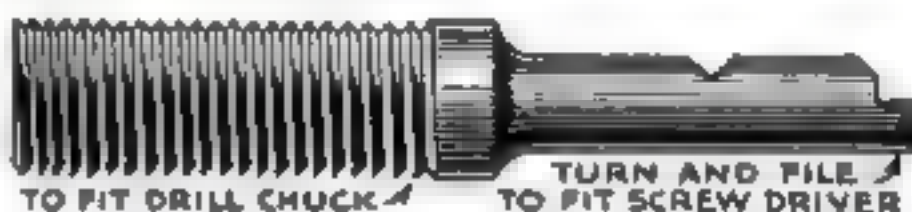
Spring Feeds Tap Wrench

ONE simple way to make a spring center to aid in feeding a tap wrench smoothly in the lathe or drill press is to modify a common tap wrench as shown. After withdrawing the sliding handle, drill a hole centrally in the wrench large enough to pass a plunger made of machine steel. A stiff coil spring is used on the plunger, and an arm is threaded into one side of the wrench to eliminate spinning.—S. J. G.

Spiral Screw Driver Used for Drilling

AN ORDINARY spiral screw driver can be easily adapted to take any size twist drill up to $\frac{1}{4}$ ". A piece of $\frac{1}{2}$ " drill rod is chucked in the lathe, and the shank is turned to fit the chuck in the screw driver. The notch and shoulder are cut in afterward with a file. While the piece is in the lathe, it is threaded to fit a very light drill chuck.

This adapter is especially useful for radio and general repairs or wherever a variety of jobs have to be done with only a very few tools.—R. B. ROCHESTER.



A light drill chuck is added to the screw driver by using an adapter made as shown in the drawing

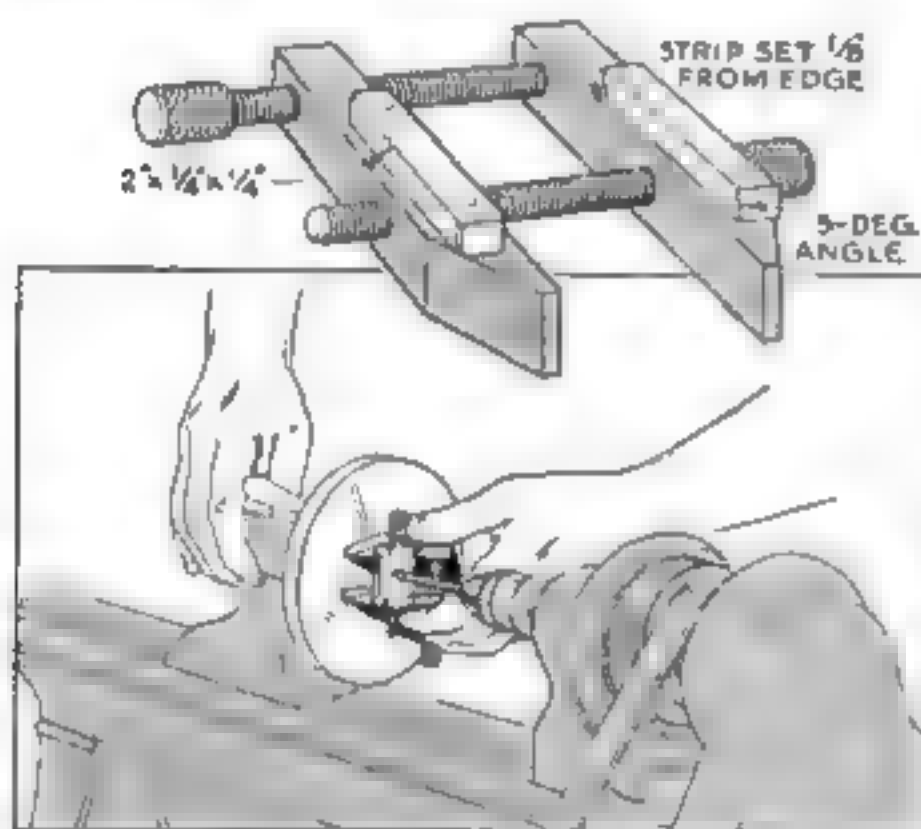
Two Tricky Shop Terms and What They Mean

THE shop terms "tolerance" and "allowance" have distinctly different meanings. Tolerance is the difference by which duplicate pieces of work may vary in size yet still be sufficiently accurate for their purpose. Allowance is the difference in dimensions of two parts to obtain a certain type of fit. The difference between the diameter of a shaft and a hole to obtain a running fit is called the allowance.—C. W. W.



Clamp Acts as Drill Vise for Small, Flat Work

SMALL pieces of flat stock can be held for drilling on a lathe or drill press or with a hand drill by riveting two pieces of steel as shown to a twenty-five-cent machinist's clamp. In this instance the pieces are $\frac{1}{4}$ " by $\frac{1}{4}$ " by 2". The face of the extra jaws is ground to about a 5-deg. angle and placed about $\frac{1}{8}$ " from the inner edge of the clamp. The holes for the rivets are countersunk, and the rivets are flush with the surface of the bars and clamp. The capacity of the clamp illustrated in the sketch below is from about $\frac{1}{4}$ " to 2".—J. W.



The extra jaws on the clamp enable small, flat pieces to be held securely while being drilled



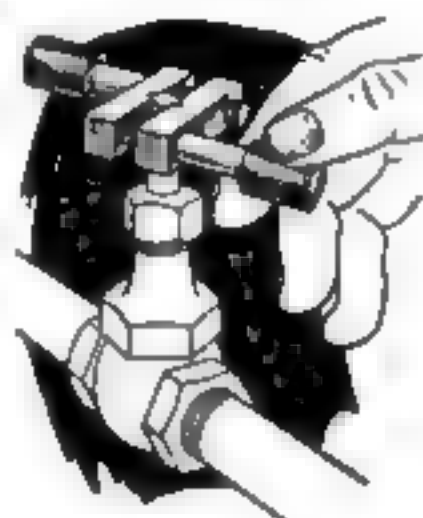
How to Repair Leaky Washer in Blowtorch

TO FIX a leak around the leather washer of a blowtorch pump, pry the washer out carefully with a nail and replace it in a reversed position. Oil the washer to soften it,

and always loosen the pump after using the blowtorch to prevent forming a deep groove on the washer.—BOHUMIL J. ZITEK.

Tap Wrench Replaces Globe-Valve Wheel

A MISSING or broken globe-valve wheel, if not too large, can be replaced by a ten-cent hand tap wrench until such time as a new wheel can be obtained. The handles are cut off to a convenient length and wrapped with tape. It will be found that the V's of the tap wrench can be tightened securely on the square stem of almost any of the smaller valves.—F. G.



CLEANING PAINTED SURFACES

[PAINTING]

Painted Woodwork. Wash with a solution of trisodium phosphate, which is sold under various trade names as a household cleaner. Use one cup of powder to ten quarts of hot water. Sponge on, let set a minute or two, and sponge off with clean water. Then wipe dry with clean rags. Do not use soap powders, which are likely to leave a film.

Painted Walls. 1. Dust walls carefully, using a vacuum-cleaner extension brush if available. 2. Use the cleanser mentioned above, but add one-half cupful of household ammonia to ten quarts of the solution, especially for kitchen walls. Clean from bottom up, sponge with fresh water, and wipe dry as fast as different sections or spaces are cleaned.

POPULAR SCIENCE MONTHLY SHOP DATA FILE



SIGN PAINTER'S PROJECTOR

By
LOUIS A. LEMBACH

The letters of a model alphabet are reflected by a mirror inside the lamp box and enlarged by a cheap lens to any size required

One letter at a time is projected directly on the sign or banner so that it can be outlined. In this way a beginner can do expert work

SIGNS and banners can be laid out quickly and expertly even by a novice with the aid of the projector illustrated. The drawings show the general construction, but dimensions will, of course, be governed by the focal length of the lens used. The lens may be taken from a pair of cheap spectacles, or a magnifying glass may be used. In this particular projector, either an 8" focal length lens mounted on the outside end of the lens mount or a 6½" lens on the inside may be used. The latter gives a larger image. Lens mounts can be made from tin cans and plywood rings.

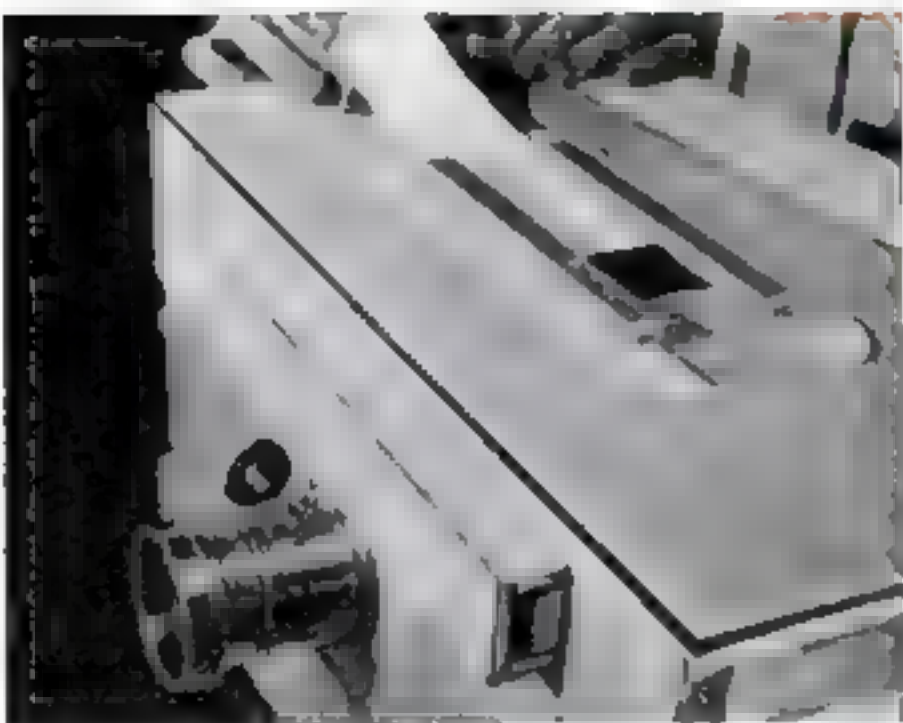
For the projector shown, the following materials were used: 3 pc. of 1" by 8" white pine 6' long; 1 pc. ¼" plywood 10" by 48"; 3 pc. 10" by 17"; ½" dowel 36" long, lens and mount obtained secondhand; a switch, cord, 2

sockets and bulbs, 2 coffee cans of the 2-lb. size, 1 mirror 5" by 7", 2 casters, 3 furniture glides, 1 bolt 4" by $\frac{1}{4}$ ", and nails, screws, and cardboard.

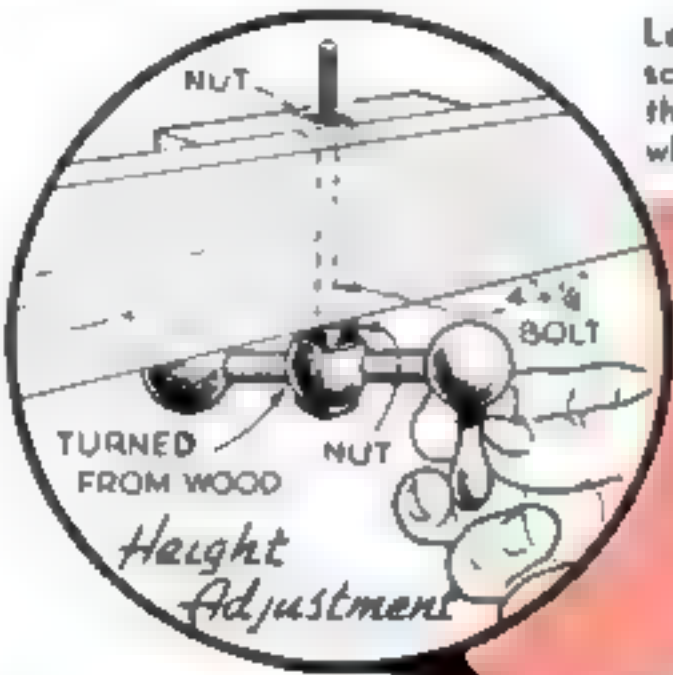
The box is built so that, at the shortest setting of the lens, the focal length is equal to the distance measured from lens to mirror to picture. Considerable latitude in focusing is given since the mirror and the lens may both be moved. The top also may be either reversed or moved forward.

Lights of 100 watts are satisfactory, but when greater intensity is needed photo-floods may be used. It is then necessary to cool by forced ventilation. The writer uses a stream of air from a paint spray compressor, which is led by a rubber tube to a pipe fitting at the rear of the box.

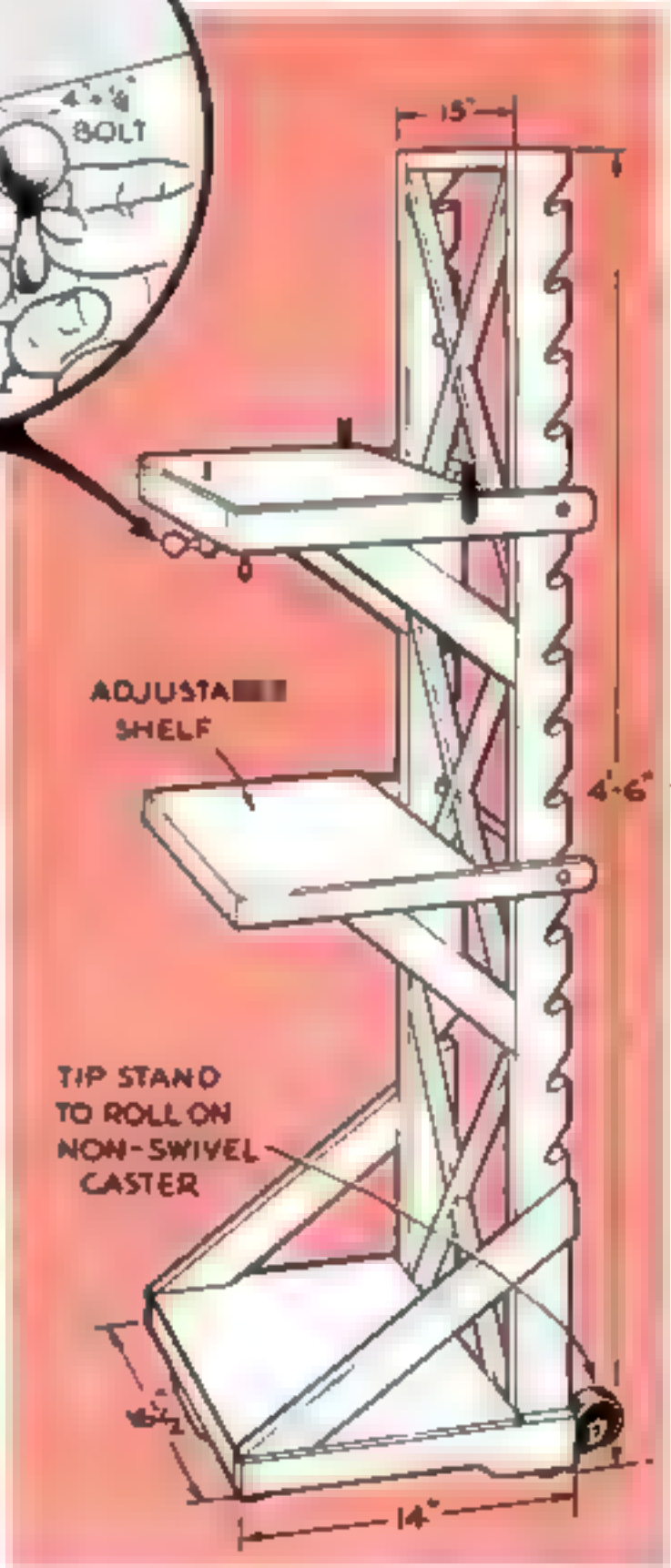
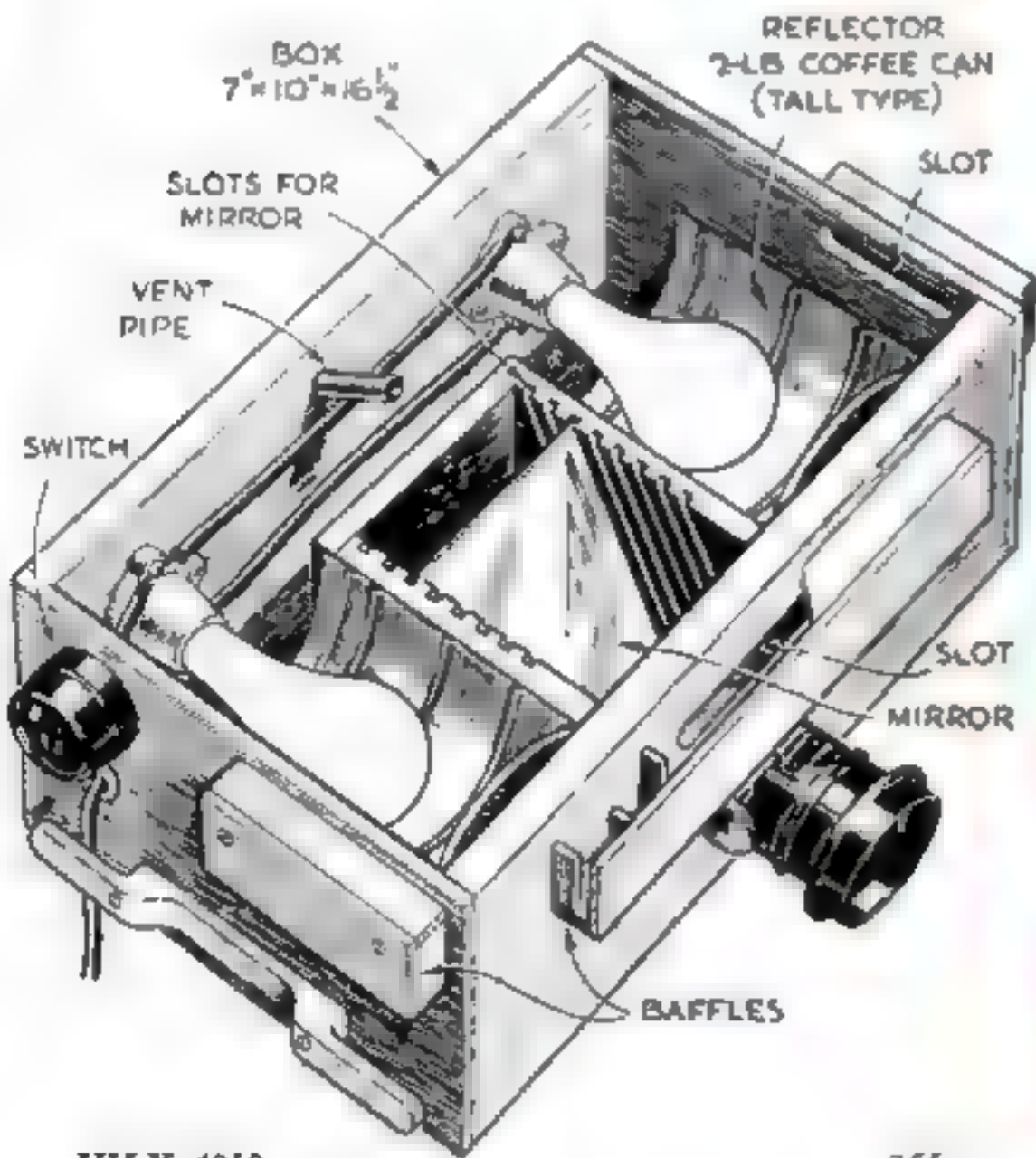
The guide on top of the projector is made to accommodate cardboard strips upon which have been printed or pasted model alphabets. Care should be taken that the upper and lower case of each alphabet is on the same base line and of the same proportionate size so that they may be used interchangeably. It is a simple matter to scale the letters so that it is known exactly how high to make them to fill a required space. After the letters have been projected and outlined on the sign, fill them in.



Model alphabets, printed or mounted on cardboard strips, are inserted face down in a slide on top



Left the height-adjustment screw. Below the design of the fully adjustable stand, which is mounted on casters



How to Copperplate Wood

**FOR SHEATHING
SHIP-MODEL HULLS
AND MAKING CARVED
PLAQUES THAT LOOK
LIKE METAL**

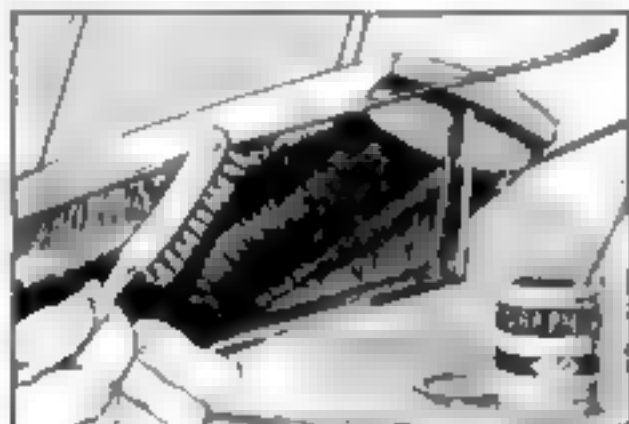
1½" beneath it, on the bottom.

Workshop handbooks give various formulas for copper-plating solutions. The one used was 20 grams copper sulphate (blue vitriol), 10 c.c. (cubic centimeters) sulphuric acid (oil of vitriol), 10 c.c. alcohol, 200 c.c. water. The copper sulphate is dissolved in the wa-

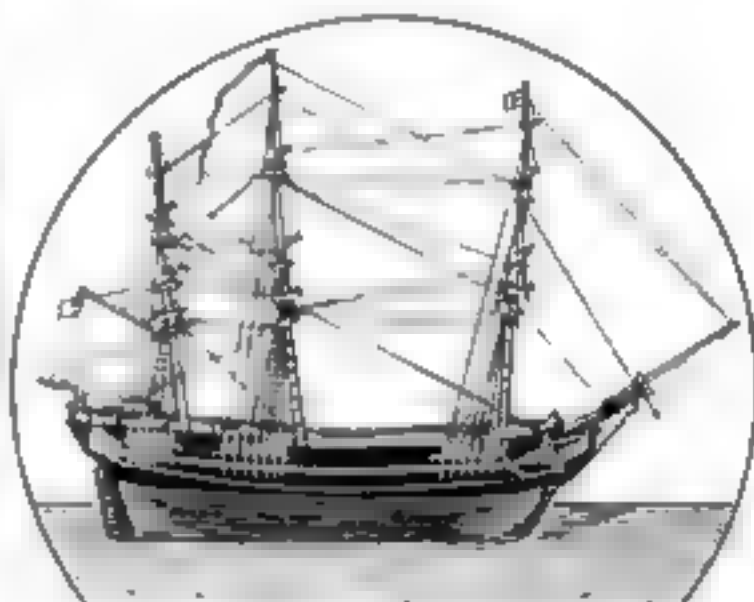


The car battery can be used to supply the current

**By
W. B. REED**



Coating the hull with lubricating graphite. At right, the completed model. Below, how plating is done



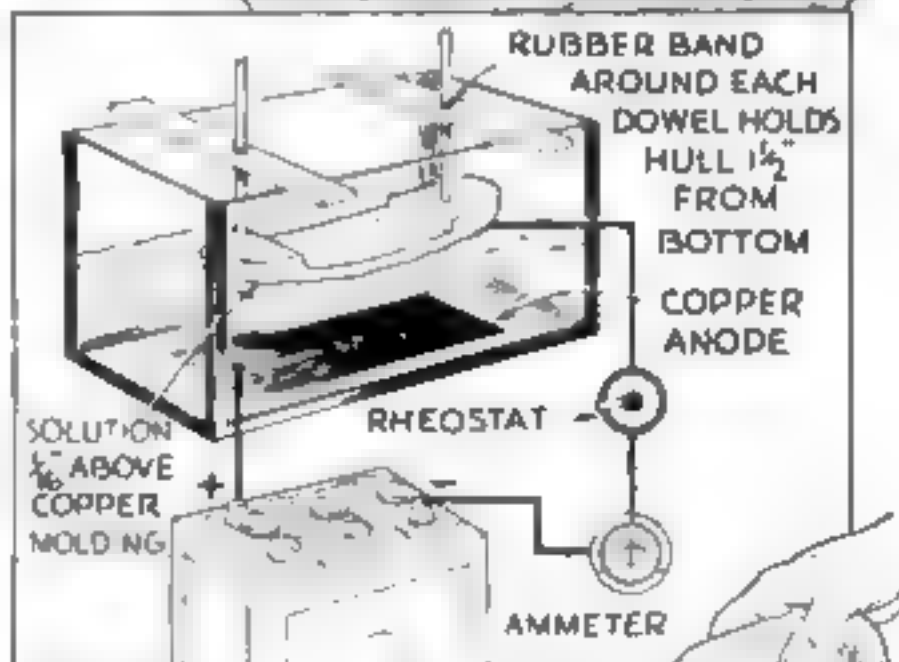
WHILE constructing a miniature ship model

of the *Bounty* (P.S.M. Blueprint No. 254), I avoided the tedious and difficult work of gluing strips of copper to the hull by a simple electroplating method.

After the hull had been shaped and sanded, it was given two coats of waterproof varnish to above the location of the wales or moldings. The latter were formed from a single continuous copper wire, both ends being left long. A shallow groove and two small nails kept the wire in position.

Next, the hull was coated with graphite powder and polished lightly all over with an old toothbrush. The graphite was extended over the copper wire, thus making electrical contact with it.

The free ends of the wire were connected with the "load" side of the ammeter in the family auto and a rheostat inserted in the circuit; and a piece of sheet copper was wired to the positive (grounded) terminal of the car battery. The hull was now suspended in the plating vessel (a glass aquarium in this case) with the copper resting



① DISSOLVE 20 GRAMS COPPER SULPHATE IN 200 C.C. WATER

② ADD 10 C.C. SULPHURIC ACID

③ THEN ADD 10 C.C. ALCOHOL

ter first, the acid poured in (WARNING: This must be done very carefully), and the alcohol added last. The mixture was poured into the plating vessel so as to rise 1/16" above the copper wire on the hull. Full battery voltage was applied until the hull began to take on a pink color, then the rheostat was cut in to reduce the current to about one or two amperes.

If a transparent vessel is not being used, it pays to take the hull out of the bath after about fifteen minutes to make sure that the plating is not developing bare patches. Small

"holes" in the plate will bridge over, but large ones must be helped by applying more graphite, lapped over the edge of the hole.

A thick enough coat was obtained in this case in about four hours. The long time and light current produce a fine-grained, tenacious deposit.

After the plating process, the extra wire

WEIGHT HOLDS
PLAQUE DOWN
UNDER SURFACE

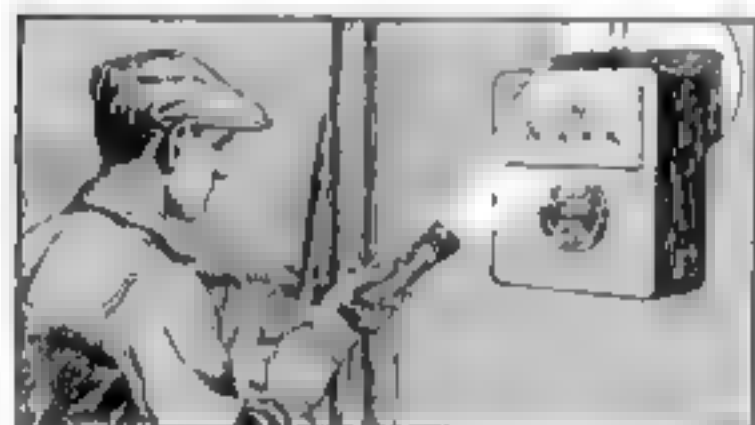
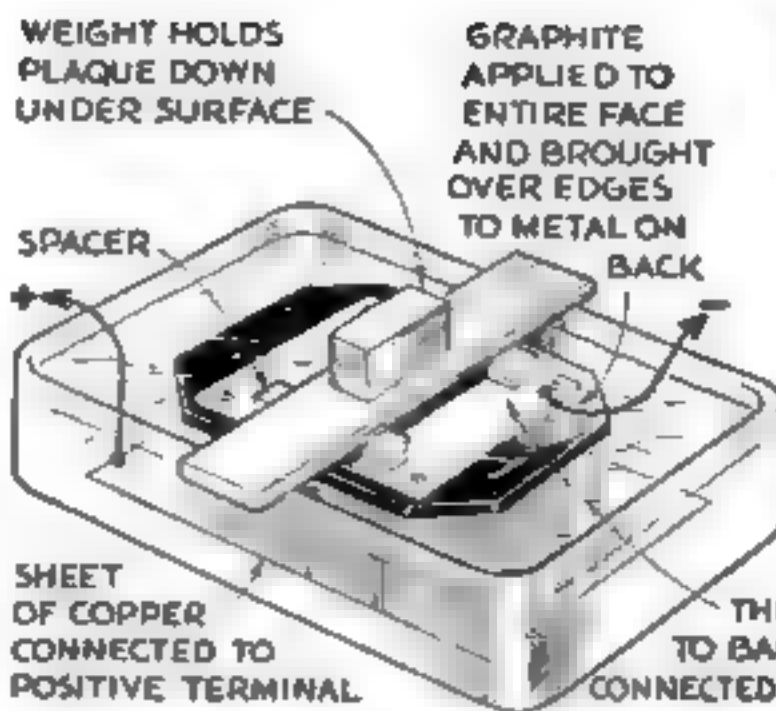
GRAPHITE
APPLIED TO
ENTIRE FACE
AND BROUGHT
OVER EDGES
TO METAL ON
BACK

SPACER

SHEET
OF COPPER
CONNECTED TO
POSITIVE TERMINAL

THIN METAL FASTENED
TO BACK OF PLAQUE AND
CONNECTED TO NEGATIVE TERMINAL

Carved wooden plaques and other craftwork projects can also be plated so they have the appearance of castings



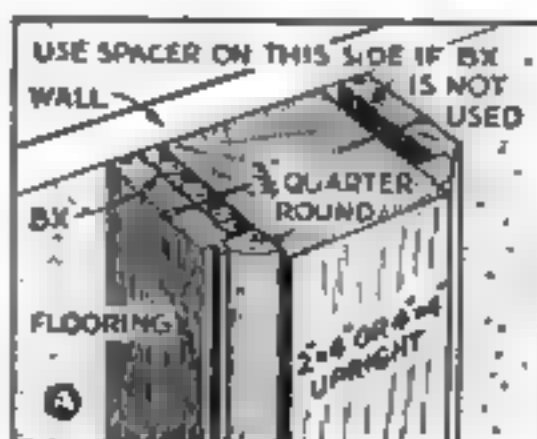
Flash-Light Batteries Given Longer Life

ELECTRICIANS, watchmen, meter readers, and others who use flash lights constantly, especially of the three-cell variety, can lengthen the life of the battery and save money by a simple expedient. When the battery becomes too weak to give satisfactory light with the regular 3.8-volt bulb, substitute a 2.5-volt bulb. As soon as the voltage becomes too low to give satisfactory light with that bulb, insert a 1.5-volt lamp. When this bulb ceases to give the proper light, a new battery must be purchased, and the procedure repeated.

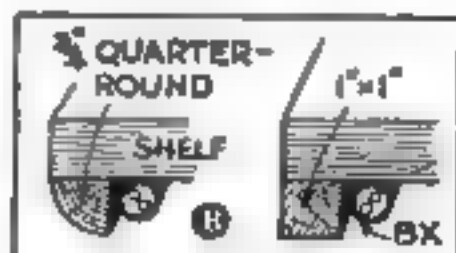
Where the battery in my flash light would last only two days by using the 3.8-volt bulb, I have extended its life to almost a week with this method.—ROGER F. VORE.

Simple Ways to Hide Wiring Around a Workbench

UNSIGHTLY BX wiring around the workbench or shop can be concealed by using common lumberyard materials. Tongue-and-grooved flooring and 1/4" quarter-round molding combine to form a neat trim on 2" by 4" and 4" by 4" up-rights as illustrated at A. If the BX cables connect convenience outlets mounted on the underside of a shelf, they can be concealed by a strip of 1/4" quarter-round or a length of 1" by 1" as shown at B.



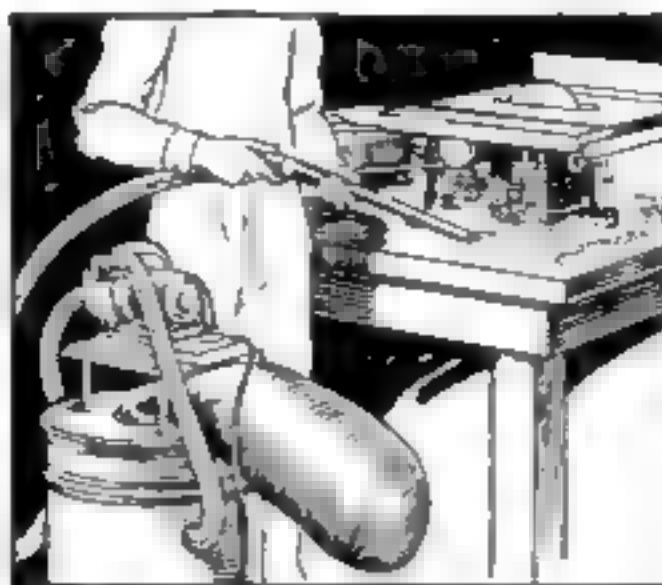
The wiring is either entirely covered as at A below, or hidden as at B



Altered Vacuum Cleaner Removes Sawdust and Furnace Soot

TO REMOVE soot from the flues of my furnace and also to clean up around my workbench, I use a vacuum cleaner mounted on a light grease drum of the 100-lb. size, which is obtainable from almost any grease station for the asking. The cover is held on by four set screws and has a rubber gasket to make it airtight. Two light iron brackets are fastened to the top with the set screws. On these brackets is fastened a 1" board to serve as the base for an old vacuum-cleaner motor.

The front of the vacuum cleaner is removed and a suction hose fitted to the opening. To the outlet opening, another piece of the hose is fitted, and this is inserted into a hole cut to fit in the side of the drum. The regular vacuum bag is fitted (with the same



The sawdust in the shop or the soot in the furnace collects in the drum; only the air escapes through the bag



bracket removed from the vacuum cleaner) over a hole cut in the center of the cover.

In using this apparatus, all the soot or dust is sucked up and forced down into the drum, and only the air escapes through the bag. The drum requires emptying about once in three months. This is done by removing the four set screws.—H. W. FUNK.

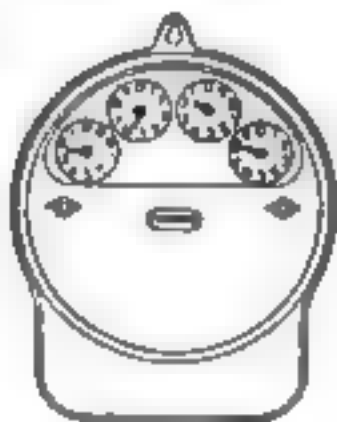
Extra Socket Improves Trouble-Lamp Cord



AUTO mechanics and others who use electric hand tools for work that also requires an extension light will find it convenient to splice a 24" or 36" length of extension cord into the trouble-lamp cord as shown. A water-tight socket or key socket is attached to the end of the short piece.—R. C. RITZ.

READING AN ELECTRIC METER

[ELECTRICAL]



Current is measured on the basis of kilowatt hours. A kilowatt hour is 1,000 watts used for one hour. Most electric meters have four dials, each with a single hand. The one on the right indicates 10 kilowatt hours when the hand has completed one revolution clockwise. The next dial to the left records 100 kilowatt hours when the hand makes its revolution counterclockwise. The third to the left registers 1,000 kilowatt hours upon completion of one clockwise revolution. The last dial registers 10,000 kilowatt hours to one counterclockwise revolution. The hand on one dial makes one complete revolution while the next hand moves one point. When the hand happens to be between two figures, the smaller of the two is used. The meter shown, for example, reads 2,518 kilowatt hours. To find the amount used in a month, subtract from the present reading the one taken the month before; then multiply this figure by the rate to find the cost.

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EQUIVALENTS OF WIRES

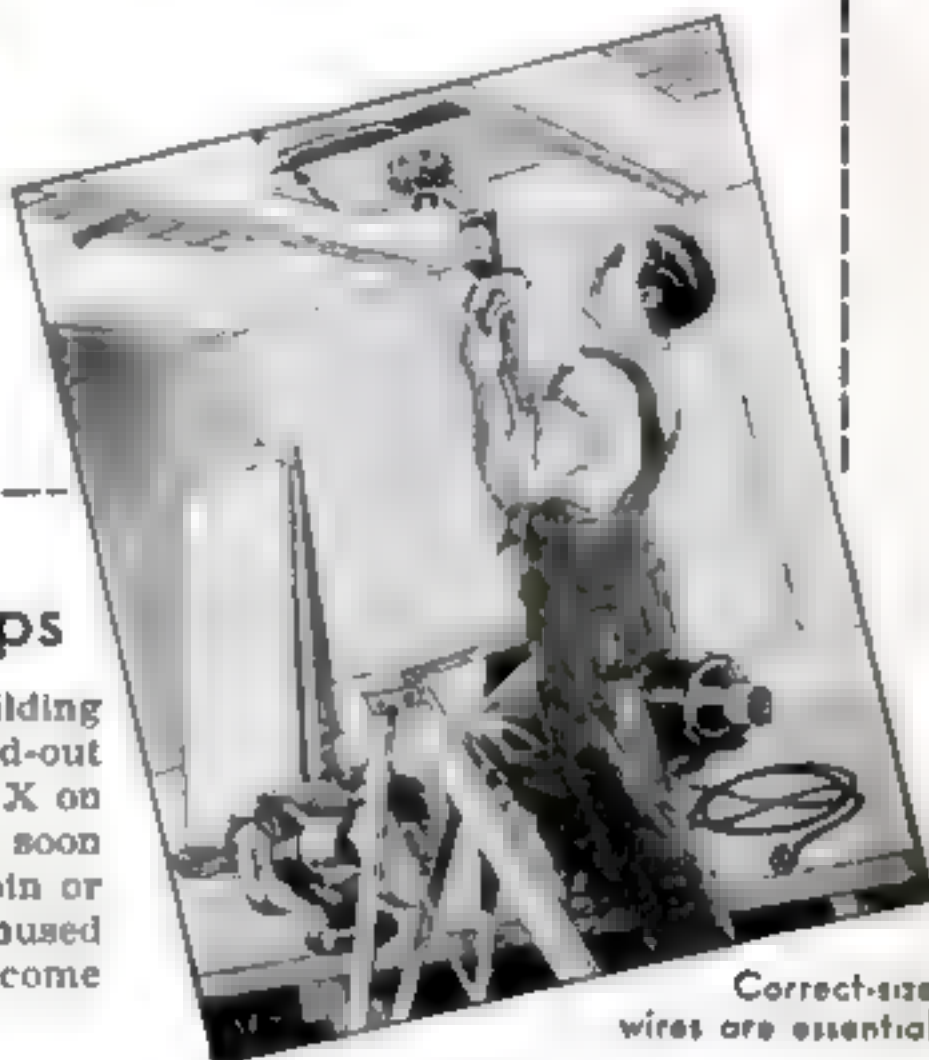
[ELECTRICAL]

| Equivalent in number of smaller conductors | | | | | | |
|--|-----|-----|-----|-----|-----|--------------|
| B & S. Gauge | 2 | 3 | 4 | 5 | 6 | Combinations |
| 10 | --- | --- | 16 | --- | 18 | 12 and 14 |
| 8 | --- | --- | 14 | --- | 16 | 10 " 12 |
| 6 | --- | --- | 12 | --- | 14 | 8 " 10 |
| 5 | 8 | 10 | --- | 12 | --- | --- |
| 4 | --- | --- | 10 | --- | --- | 6 " 8 |
| 3 | 6 | 8 | --- | 10 | --- | --- |
| 2 | 5 | --- | 8 | --- | --- | 4 " 6 |
| 1 | 4 | 6 | --- | 8 | --- | 3 " 5 |

Sometimes the desired size of wire is not at hand and it is well to know what sizes or combinations can be substituted to carry the same current safely. These are given above.

As an example of how this table can be used, let us assume that a load of 50 amperes is to be carried on a submain which normally calls for a No. 6 wire. If none of this size wire is at hand, we could temporarily use four No. 12 or six No. 14 wires, or a No. 8 and a No. 10 wire in combination. If the ends are well cleaned and twisted tightly together to form a cable, these wires would answer for the single wire. It is best, however, to obtain a single wire of the correct size for a permanent job.

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Correct-size wires are essential

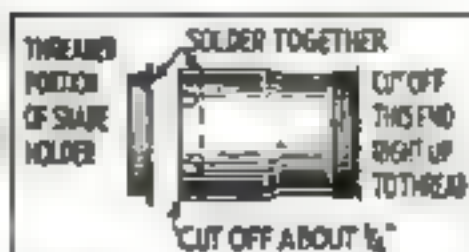
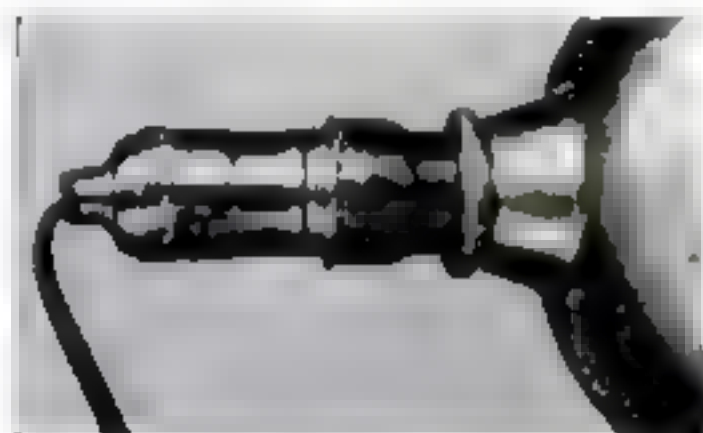
Marking Burned-Out Lamps

IN A LARGE factory, theater, or other building where it is necessary to replace many burned-out electric lamps, it is a good idea to mark an X on the lead center contact point of each bulb as soon as it is removed. This can be done with a coin or even a finger nail. In this way, used and unused bulbs may easily be told apart even if they become mixed up.—WILLIAM F. JONES.

Old Socket Serves as an Adapter for a Large Photoflood Bulb

A USEFUL and inexpensive socket extension can easily be made so that a No. 2 photoflood bulb may be used in a reflector intended for a No. 1 bulb. It is merely the bottom shell from an old socket with the threaded portion of five-

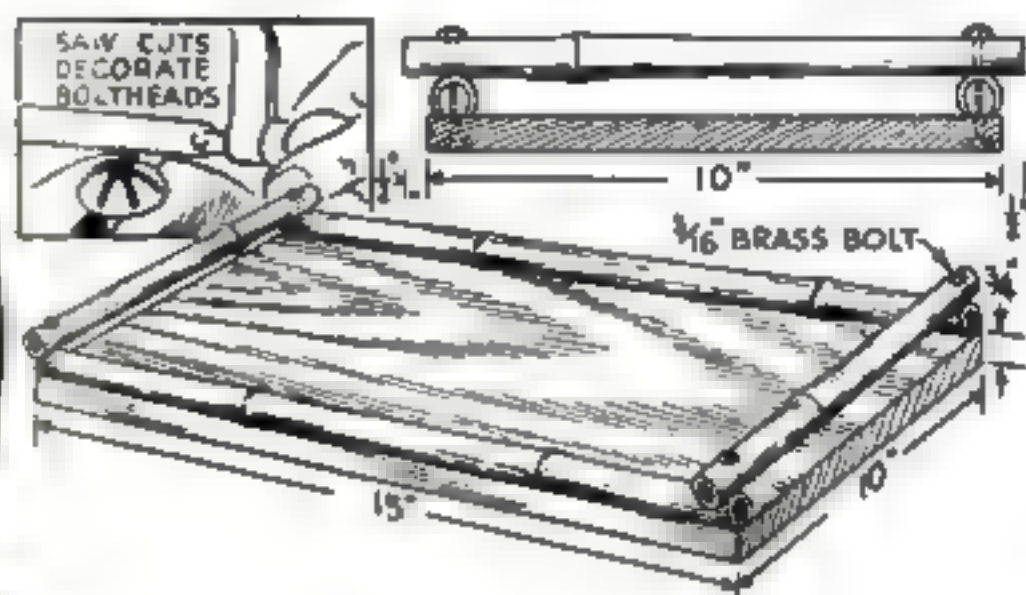
cent shade holder soldered to the upper end. The photo at left shows how far the neck of the bulb sinks into the extension when the adapter is used. This places the filament of the No. 2 photoflood where it gives higher efficiency.



Push-Pull Auto Switch Handy on Enlarger

AN AUTO instrument-board switch of the push-pull kind, which is of sturdy construction and very well insulated, is better adapted and handler for use on an enlarger than the usual "in-the-cord" type of switch. It is mounted as shown above on a short piece of chromium-plated brass tubing obtained from a plumber and makes a neat-looking job.—JOSEPH WILLIAMS.

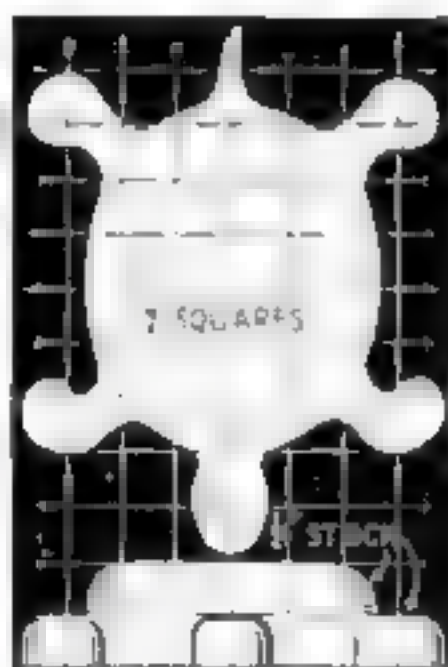
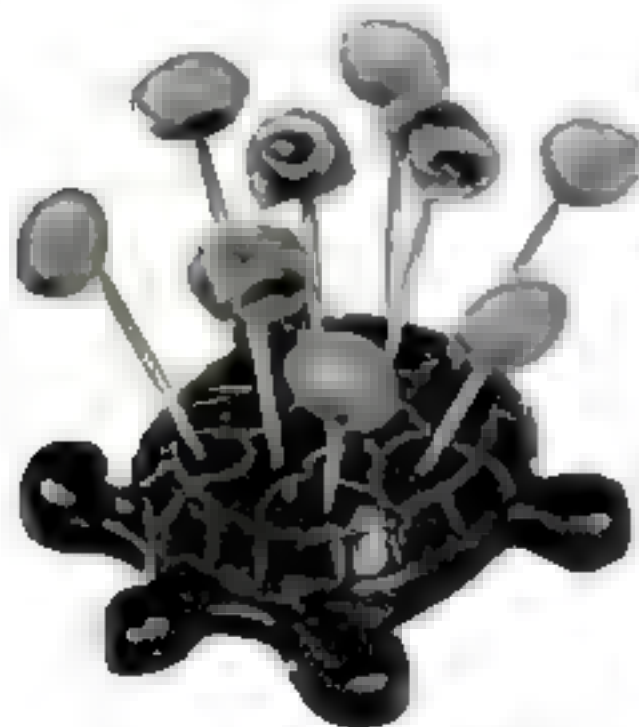
Bamboo Handles and Rails Trim This Plywood Refreshment Tray



HERE is a cool-looking refreshment tray from which to serve iced drinks on a hot summer day. The only materials required for its construction are a 5' length of bamboo rod about 1" in diameter; a $\frac{1}{16}$ " board, 10" by 15", of white pine, poplar, or other light-colored wood; and four $\frac{3}{16}$ "

roundhead brass bolts that are $2\frac{1}{2}$ " long.

The piece of bamboo used in making the railing on the two sides of the tray is flattened on one side by sawing off a thin slice. The two bamboo crosspieces, one at each end, serve as the end railings and also as handles. The four pieces are fastened to the base with the bolts. The heads of the bolts may be sawed crosswise with a hack saw to improve their appearance. Sink the nuts into the wood on the bottom. Finish the tray with several coats of clear varnish or lacquer.—GEORGE A. SMITH.



Turtle-Shaped Titbit Holder

A GAY little turtle, bristling with tempting appetizers, can easily be made for that next afternoon tea or cocktail party. This is another readily salable design from the workshops of the Metropolitan Junior Achievement, New York. The server is made in two parts from tortoise-shell cast-resin plastic, $\frac{1}{2}$ " thick. Other colors or materials may be used, if desired. The underpart and shell are cut out with a jig saw. Head, feet, tail, and shell are then carved to shape with a hand motor grinding tool. A dozen small holes are drilled in the shell, inclining slightly outward as shown, to hold toothpicks.

Clarinet Floor Stand Made from Scraps

THE clarinet stand shown below is made from a 6" length of broomstick and a plug from a roll of wrapping paper (obtainable from your grocer). Glue the broomstick in the plug and taper off the top until the clarinet fits snugly. Mount on a 6" by 6" plywood base and glue felt over the tapered parts as well as under the base.—W. L. S.





Memo Pad Concealed Behind Photograph in Hinged Picture Frame

A NEAT way to conceal a memo pad on a desk or telephone in one's home is to mount it behind a framed photograph in such a way that the picture can be tilted down as shown in a convenient position for writing.

The back of a conventional picture frame is replaced with a plywood piece to which is fastened a small spring paper clip. A pencil clip is constructed from sheet metal and fastened with a small screw before it is fully bent in shape. A small end projects from

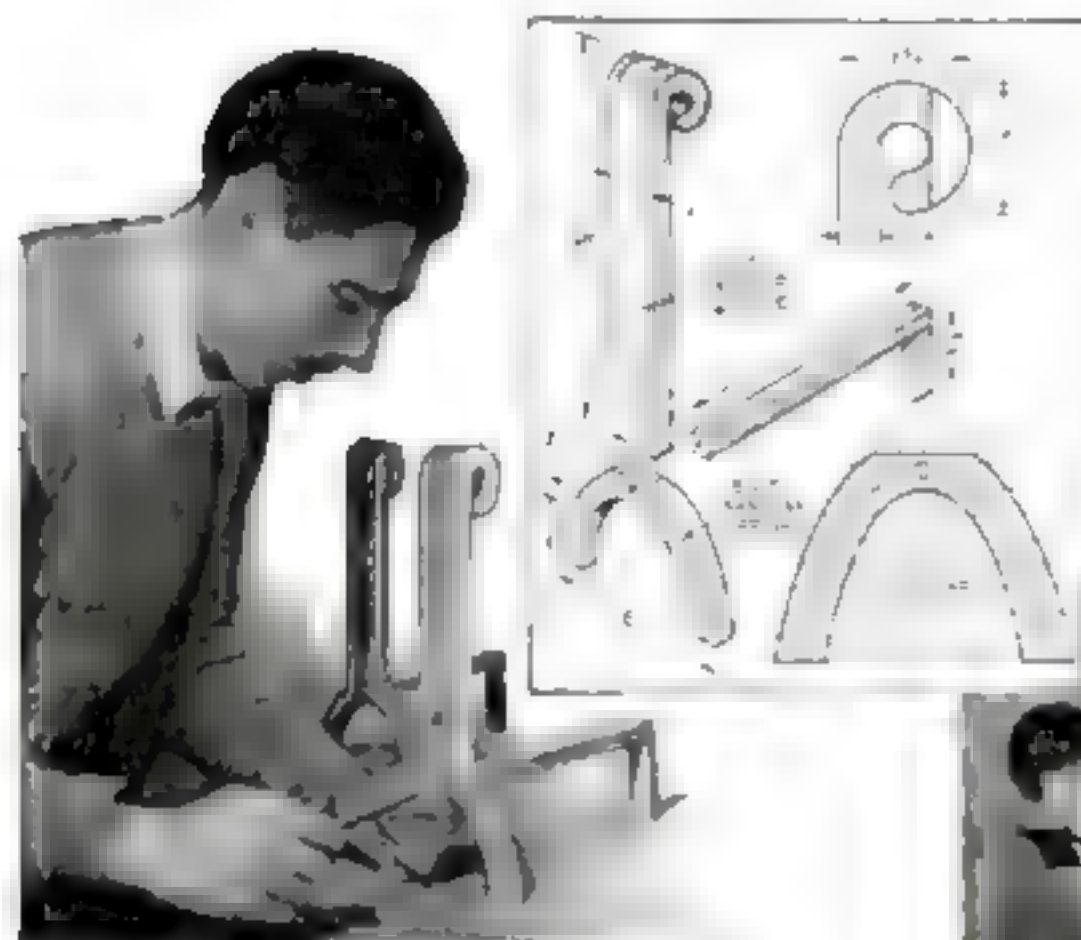
this holder and holds the bottom of the pad in place. The base is made as shown from hard-

wood or plastic. Small hinges fasten the picture frame to the base. The light-colored half-round member of the base should be cut out so the frame will slope slightly back when in the standing position. The size of the base will depend, of course, upon the size of the picture frame and should be of suitable proportion.—M. G. WINTERTON.

BASE AND HALF-ROUND PIECE MADE FROM FINE WOOD OR PLASTIC



Modernistic Andirons Constructed of Wood



Casein glue and flathead wood screws, with the heads countersunk and puttied over, are used to join the pieces together.

After a coat of shellac has been applied, rub the andirons down with fine sandpaper. A copper finish is then obtained by using copper bronzing powder with clear lacquer as a medium. The slots are painted black.—FRANK MCCARTY.

TWO andirons, a few birch logs, and a red light give a realistic touch to an artificial modern fireplace. The andirons are made from a $\frac{3}{8}$ " thick board. Two extra blocks are glued on the back of the top of each upright to provide stock for the roll. The decorative slots can be cut with a narrow chisel.



Copper Stands to Hold Flowerpots



Riveting the legs and rings together. Right: truing up the bottom corner of the pan



ORDINARY red flowerpots are commonplace in appearance by themselves, but if they are set in copper holders of the type illustrated they become quite attractive. The copper is given a soft green finish that blends well with the red clay.

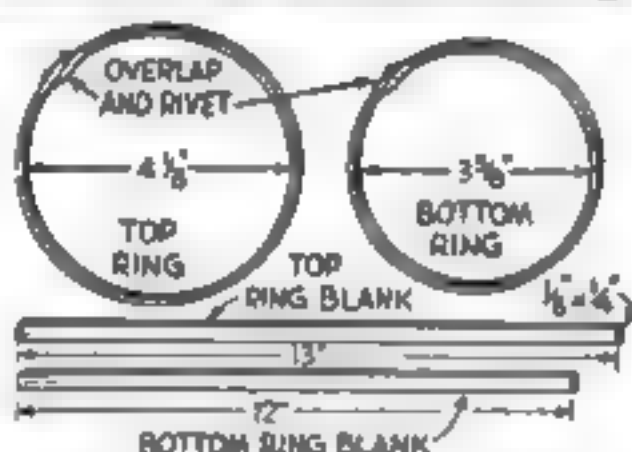
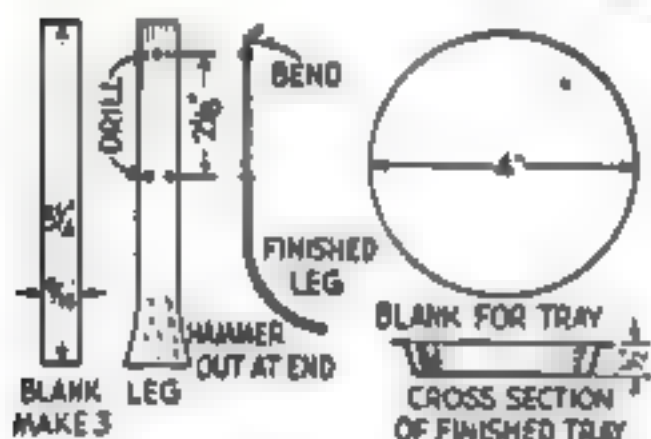
The sizes may have to be varied, but the two rings are made from $\frac{1}{4}$ " strips of $\frac{1}{8}$ " soft sheet copper. Hammering will lengthen the strips slightly.

Three legs are cut from 18-gauge soft sheet copper, then hammered, drilled, and bent to shape. Corresponding

holes are drilled in the rings, and the pieces are assembled with rivets. The pan is cut from 18-gauge soft copper and raised in the usual manner. The bottom corner is trued up with a riveting hammer as illustrated. A $\frac{3}{16}$ " rim is formed around the top.

When the holder has been completed, coat the surface lightly with liquid copper nitrate, let dry in a warm place, then lacquer. If preferred, the holders may be made from iron and painted green or black.

—DICK HUTCHINSON.



COLORING BRASS AND COPPER

[METAL WORKING]

A mottled patina may be obtained on brass or copper as follows after the metal has been properly cleaned:

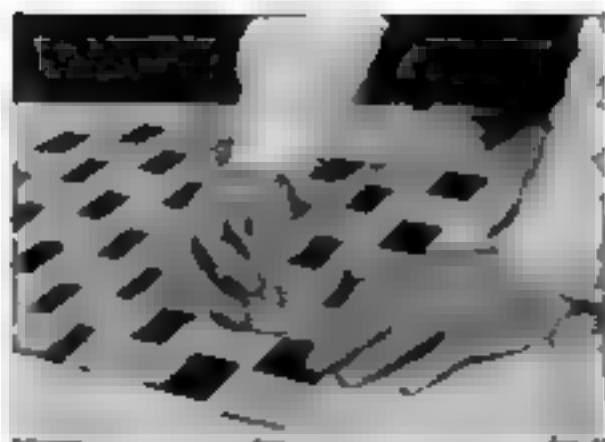
In 1 qt. of water dissolve 1 oz. of nitrate of copper, 1 oz. sal ammoniac, and 1 oz. calcium chloride. Daub the solution on the piece to be colored with a cloth swab, applying where necessary to produce the desired mottled green effect. Do not let the solution come in contact with the hands or clothing. A coat of lacquer applied over this finish will tone down the color to the right shade.

An antique finish on brass may be obtained simply by heating the metal until it darkens; then wax with floor wax and polish.

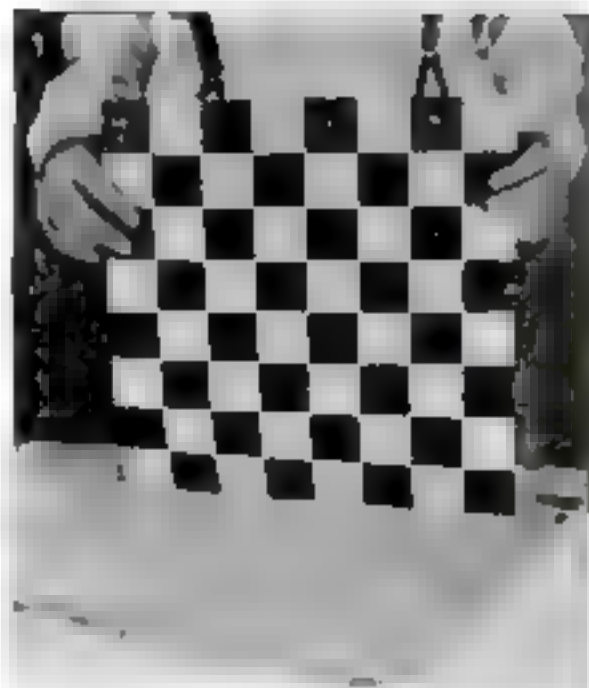
A variety of colors may be produced on copper, varying from copper color to red and on to various shades of brown, simply by heating the metal over a gentle heat. This finish is quite permanent when coated with floor wax and polished.



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Left, a print trimmer cuts the squares. Above, taping pieces together to form a checkerboard as at right. Below, gluing the taped veneer to a plywood panel

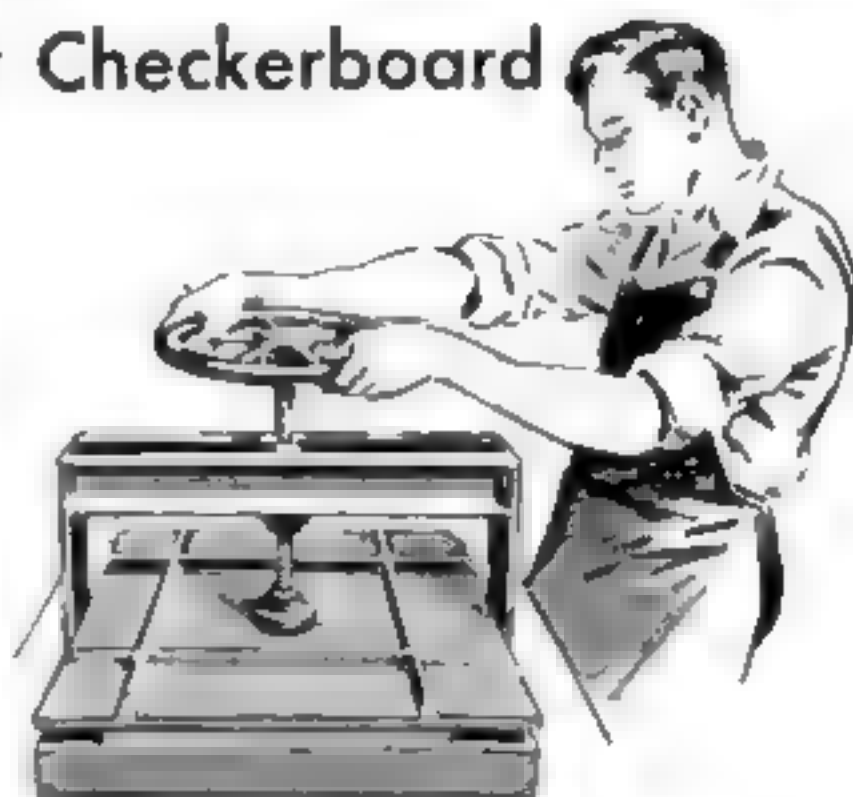


Cutting Veneer Squares for Checkerboard

WOULD you like to make an inlaid checker- or chessboard from rare wood veneers, but hesitate to attempt to cut so many perfect squares? If you have a photographic trimming board, you can clip out the whole sixty-four in a few minutes. White holly is an excellent veneer for the white squares. Macassar ebony, East India rosewood, or almost any dark, nicely grained wood veneer will make the dark squares.

After the squares have been cut, lay them on a smooth surface and arrange them in checkerboard pattern. Then carefully bind them together, row after row, with ordinary Manila adhesive tape. The untaped side of the checkerboard is now glued to a plywood panel slightly larger than itself with white casein glue, carefully spread out. Let the work set overnight in a press or between two boards held tightly together with hand screws.

The next day the tape may be removed



with sandpaper, and the excess plywood sawed away. Finishing is done by smoothing the veneer with very fine sandpaper, then giving it a coat each of thin white shellac and clear lacquer. The edge of the plywood may be veneered or enameled black.



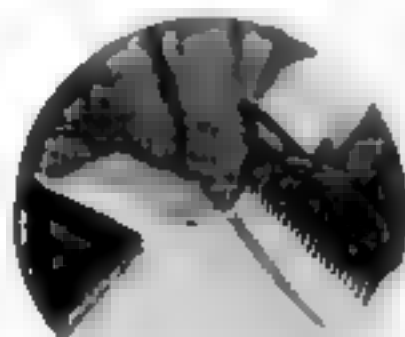
Toothbrushes Form Magnifier Stand

AN ADJUSTABLE stand for a magnifying glass can be made from two discarded toothbrushes, three roundhead screws, and a small block of wood. The magnifying glass should be of the type having a celluloid handle. This is soft-

ened by holding it over the spout of a steaming teakettle, then bent slowly and carefully. The bristles are sawed off the toothbrushes, small holes are drilled for the screws, and the stand is assembled with fairly tight joints.—W. J. DOUGLASS.

Comb Stamps Dotted Lines

WHEN it is necessary to draw a number of dotted lines, the work can be done quickly and neatly by using a comb as if it were a rubber stamp. It is inked on a black-ink stamp pad; that is, as many teeth are inked as are needed for the length of line.

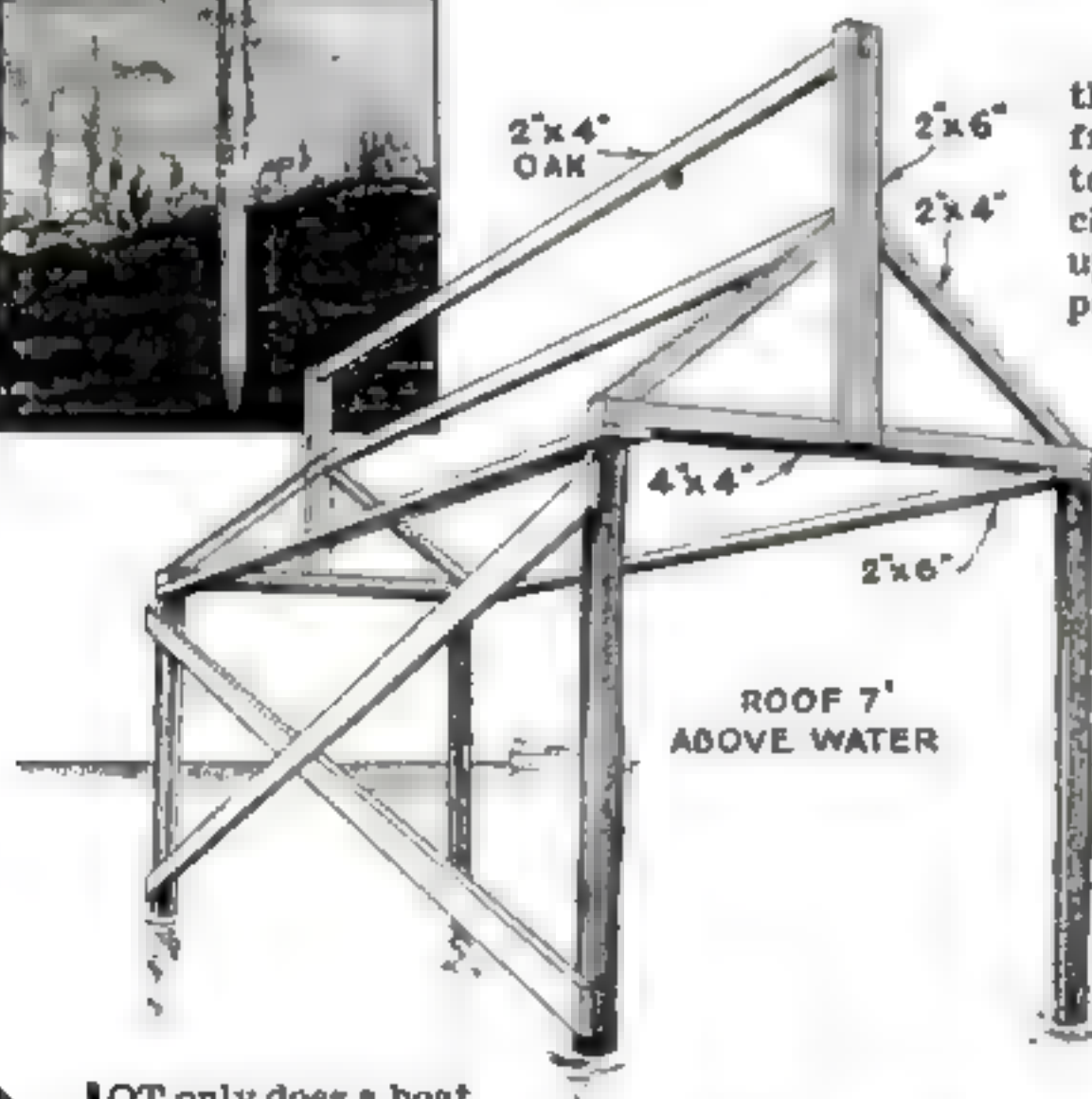
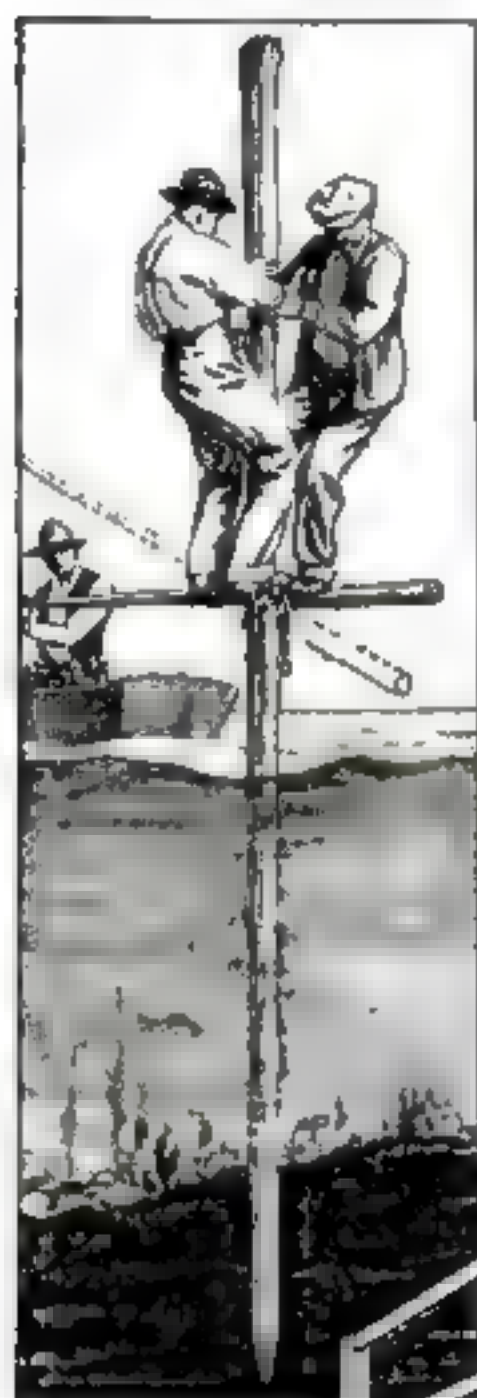


Right, boat shelter in use. A more typical method of construction is shown in the drawing. The long piles are sunk as shown below



Drive-In Boat Shelter

FOR YEAR-'ROUND USE



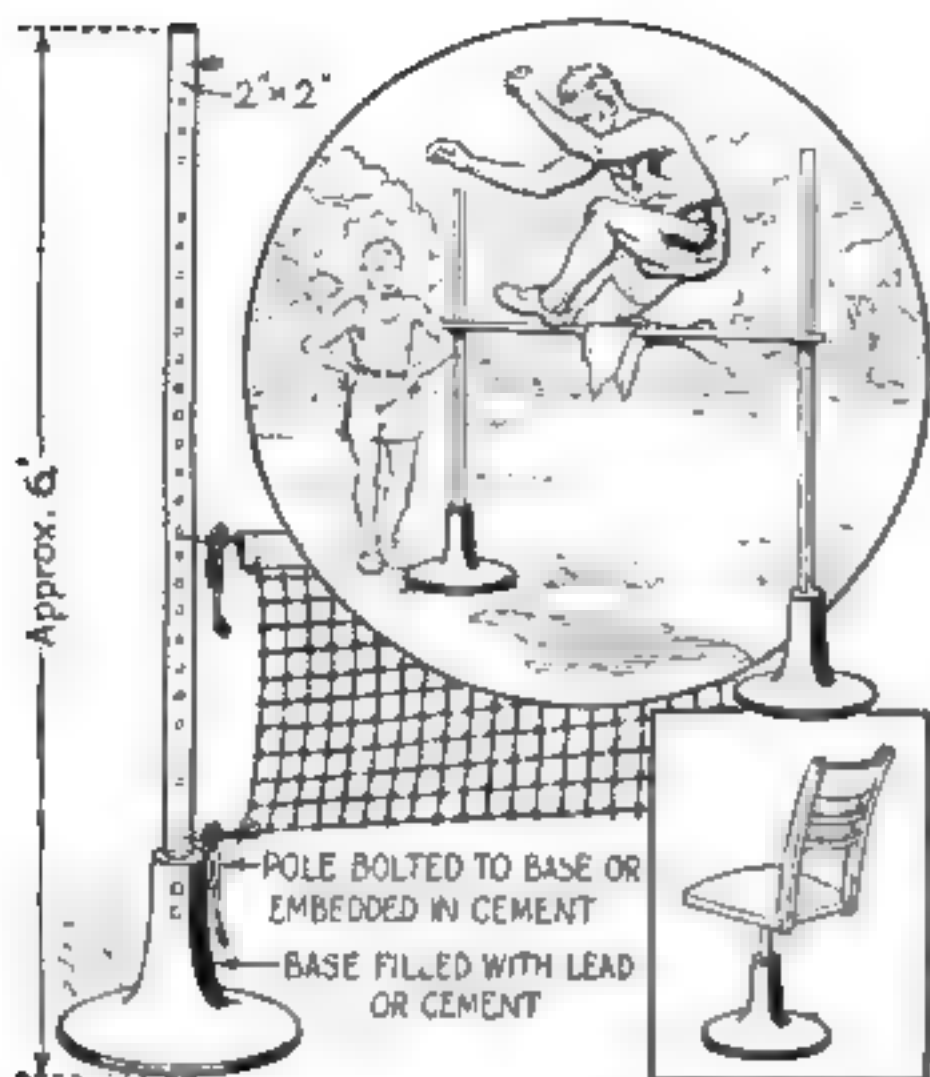
the water from an anchored boat (or from a wharf if you build the shelter alongside it). A short length of chain is hooked around the pile 3' up from the water, and a strong pole slipped through the loop in an upright position. Bearing down on this tightens the chain about the pile. One man steadies the end of the pole while two others climb on it at either side of the pile, to which they cling. Then they jump up and down to "tread" it into the bottom, getting off only to raise the chain as necessary.

The chain hoist or other lifting device in the finished shelter should be just above the center of gravity of the boat and motor. This point is easily determined by lifting on ropes slung about the boat at different points. Insert eyebolts through the keel 2' forward and aft of this point so a wire-rope sling can be hooked into them and thrown over the hook of the hoist. A common pulley and rope will hold up the forward end of the boat if the position has been located correctly as described and this type of bridle is used.—J. A. EMMETT.

NOT only does a boat shelter of this type afford protection against sun and rain, but at laying-up time the boat can be hoisted right up under the roof and safely left until spring.

Driving the four long corner piles is the only part of the work likely to puzzle a boat owner. The sharpened pile is suspended in

ward and aft of this point so a wire-rope sling can be hooked into them and thrown over the hook of the hoist. A common pulley and rope will hold up the forward end of the boat if the position has been located correctly as described and this type of bridle is used.—J. A. EMMETT.



Gym Standards Supported by Old Chair Irons

OLD schoolroom chair irons make excellent bases for gym or playground standards to support tennis or volley-ball nets or a crossbar for high jumping. Weight may be added by filling the inside with lead or cement. The wooden uprights are 2" by 2" by 6', fitted into the opening in the top of each base and either bolted in place or embedded in the lead or cement.

Starting at about 18" from the ground, $\frac{1}{4}$ " holes should be bored every 2" in the uprights to receive the pegs for holding the crossbar to be used for jumping. On an adjacent side three screw eyes should be placed, one just above the base, one 36" from the ground, and one just below the top. These screw eyes serve for attaching the net ropes for tennis, volley ball, or any other net games.—R. M. WOODBURY.

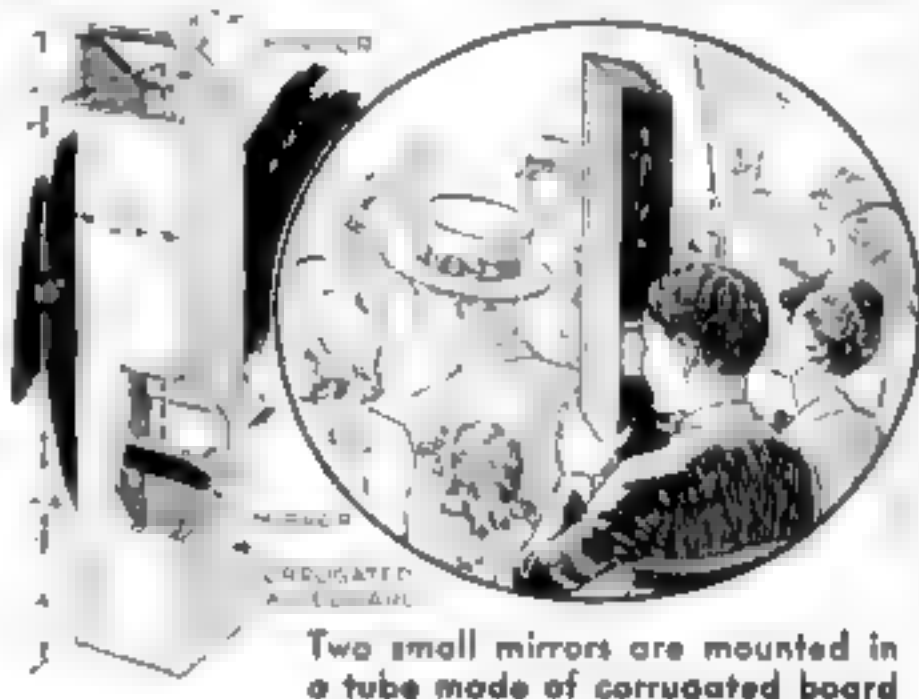


Rubber Pads for Back-Pack Straps

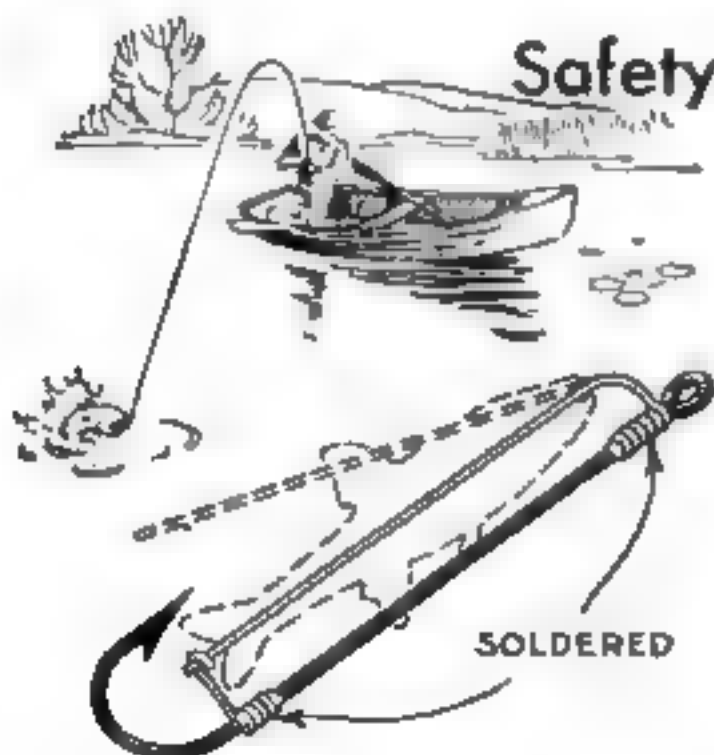
TO PREVENT the shoulder straps of my camping pack from cutting into my shoulders, I bought an ordinary kneeling pad and cut it as shown. The straps were run through the slits, and the pads placed between the shoulders and the straps.—CHARLES BECK.

Quickly Made Periscope

CHEAP periscopes are sold for viewing parades and other spectacles where crowds prevent an unobstructed view, but are not always obtainable when needed. In such cases a substitute may be made as shown below from a good grade of corrugated board, assembled with adhesive tape. The mirrors must be accurately set at 45-deg.



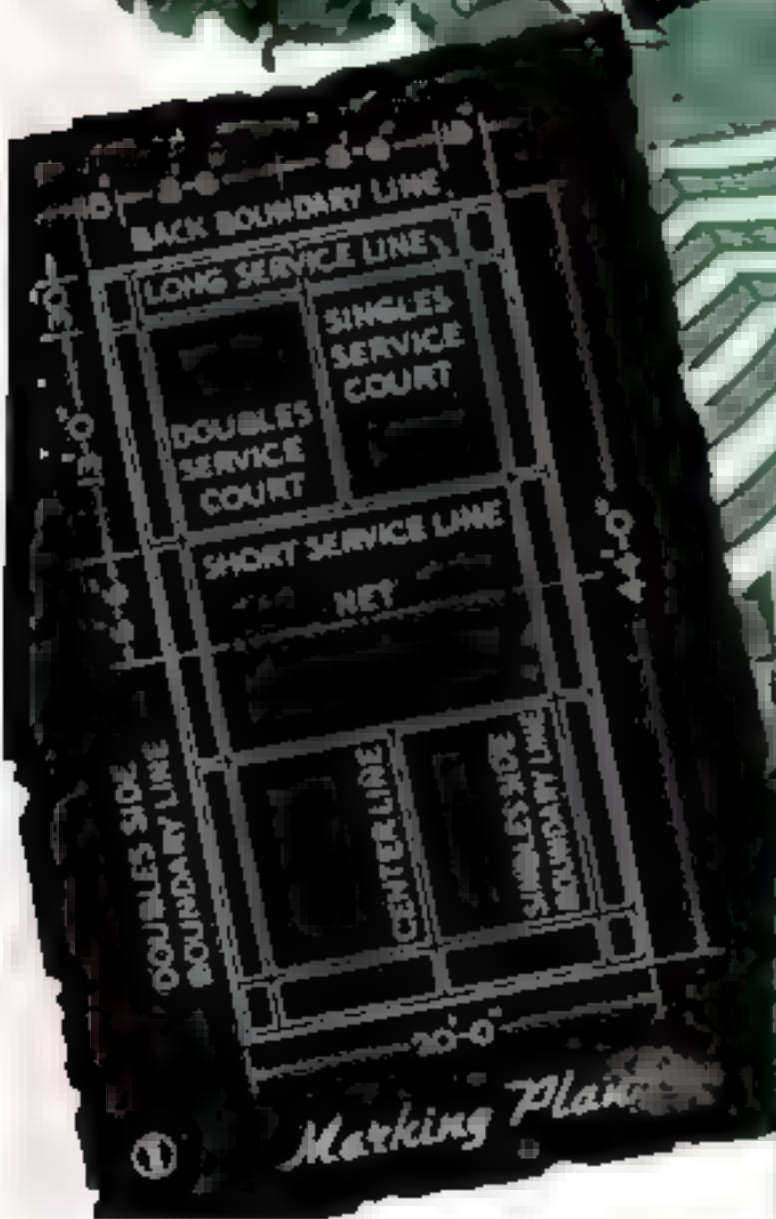
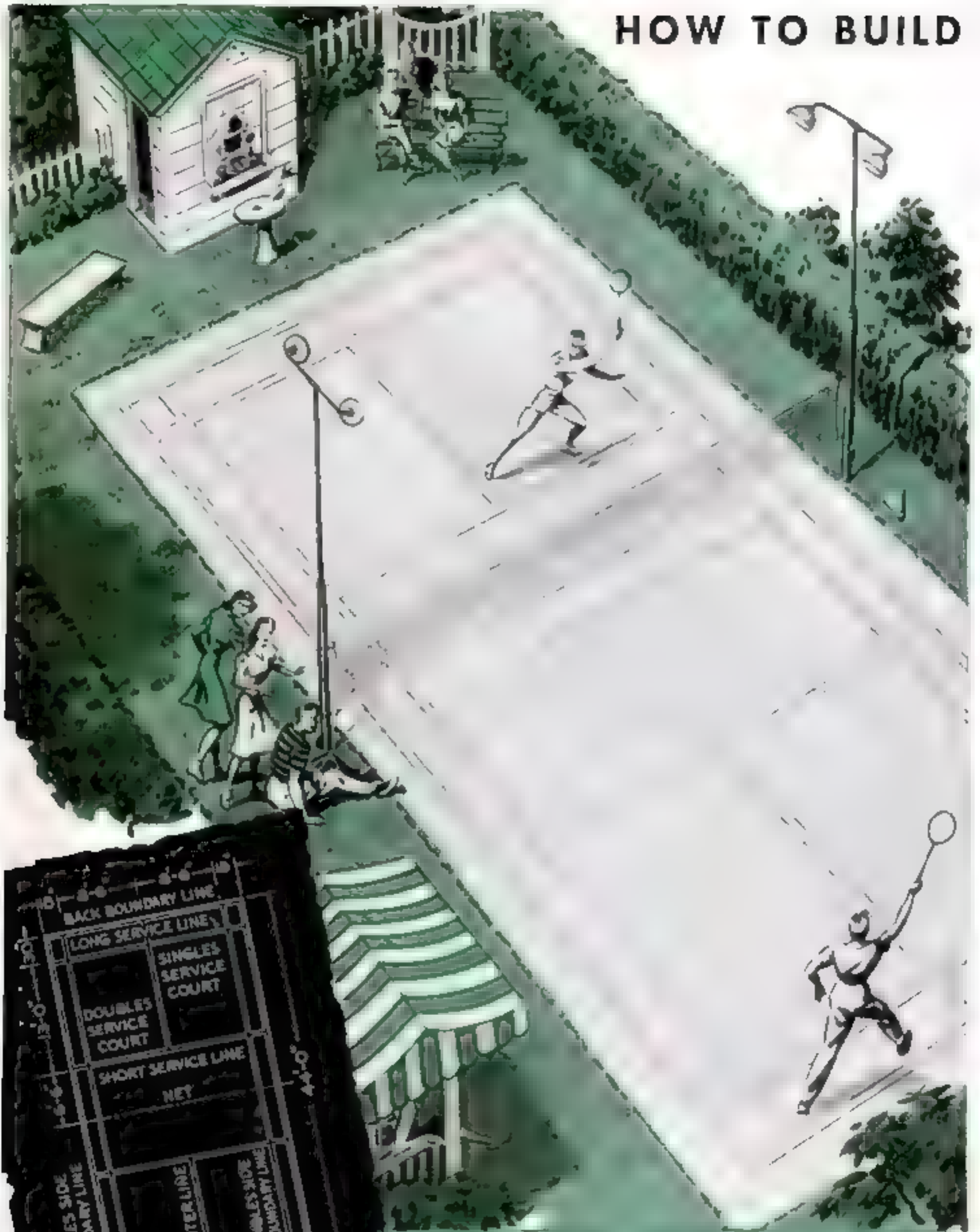
Safety-Pin Fishhook Holds Minnow Firmly



RECENTLY a fisherman showed me some hooks he had made for keeping minnows on the hook when casting or trolling. He found that these hooks saved considerable bait and also time spent in rebaiting ordinary hooks. A long hook is used, and an auxiliary device like a common safety pin is attached to it to hold the minnow. This pin can be made from piano wire or from the wire in a safety pin. Wind it around the hook and solder in place.—B. K.

IN BUILDING a tool chest, some expense for hardware can be avoided by using the lock and snaps from a discarded trunk or even a worn-out suitcase.—R. D.

HOW TO BUILD



| DIRT COURT SAND AND SIFTED TOP SOIL | BITUMINOUS ROCK EMULSION AND SAND | ASPHALT-CONCRETE Laid HOT AND ROLLED |
|---|---|--|
| 2-4 2 | 2-4 3 | 2-2 4 |

A Badminton Court

IF YOU have a neglected piece of ground at the end of your lot, it can be put to excellent use and made decorative as well by building a badminton court. The standard court (Fig. 1) is only 20' by 44', but a little extra space should be available on all sides; at least, no wall should abut directly upon a boundary line.

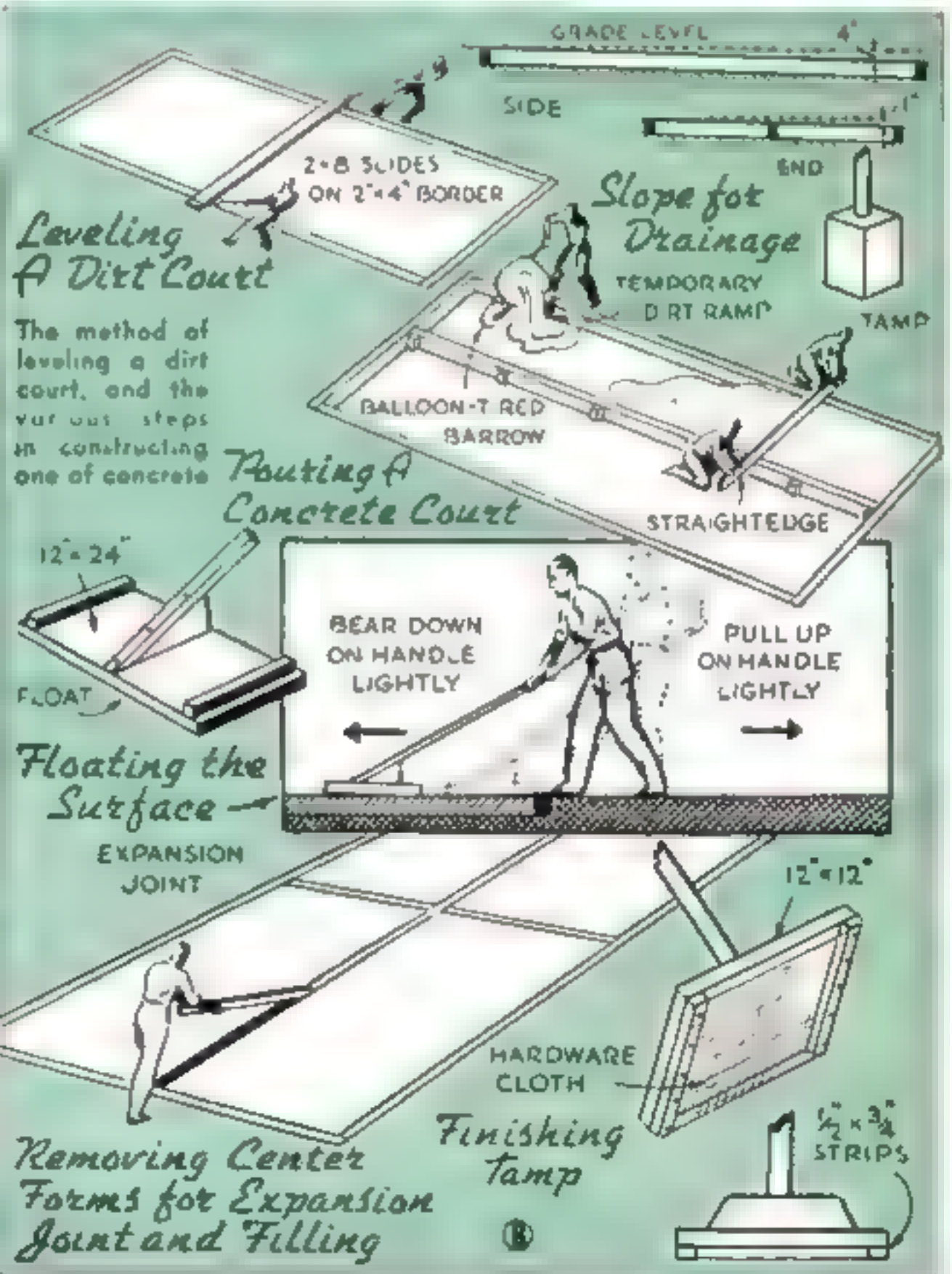
Several kinds of paving are satisfactory. The least expensive is a dirt court, Fig. 2. This kind is dependable if scraped or rolled after each playing. Excavate to a depth of 3" or 4", set in two-by-fours for borders, and fill with a mixture of top soil, sifted through $\frac{1}{4}$ " mesh hardware cloth, and sand. The top soil acts as a binding agent, and the sand

permits a reasonable amount of drainage.

Tamp and roll the entire area, then draw a heavy beam across it to scrape it level as shown at the top of Fig. 6. The border pieces should be aligned to give a slope of 4" toward one end and about 1" to the side. This is to carry off the rainfall.

Another paving is a bituminous emulsion sold by certain oil companies for this and similar purposes. It is of a tarlike consistency and hardens soon after exposure to the air. The liquid is sprayed with special equipment over a dirt court, and No. 3 or No. 4 crushed rock is then spread over and leveled. This is bound with another application of the emulsion. When the court is filled level as in

By
HI SIBLEY



CONCRETE
CEMENT 2, SAND-5,
GRAVEL-5

2 x 4

5



Painting the lines is slow work, but it can be speeded up by making a wooden guide. Above, the type of brush to use

Fig. 3, sand is rolled in, making a smooth, continuous surface.

Asphalt-concrete (Fig. 4) is in favor in some localities, but this is laid on hot, much like street pavement, and therefore generally requires experienced labor.

Probably the majority of badminton courts in Southern California, where any number of new homes are being provided with them, are built of concrete (Fig. 5). In this section, a 3" thickness is the rule, but in colder climates subject to frost, at least 4" is advisable.

Excavate and grade the area with the proper slope and set in two-by-fours as shown in Fig. 6. Tamp the earth well and, the night before pouring, sprinkle with a hose so that the soil will not absorb moisture from the cement.

If available in your locality, you will find it an advantage to use ready-mixed concrete. If not, at

least rent a power mixer because it would be a prodigious undertaking by hand. The proportions are two parts Portland cement, five of sand, and five of gravel, with the proper amount of water for the required consistency. This varies from 4 1/4 to 6 1/2 gal. to a sack of cement, depending upon how moist or dry the sand and gravel are.

A balloon-tired steel wheelbarrow is a convenience, and a dirt ramp is made over the wood form. Level the concrete with a straightedge and smooth it with a float, as illustrated in Fig. 6. By bearing down lightly on the handle when pushing, it brings the forward edge up slightly; and use the reverse process when pulling on the float.

For forcing the stones below the surface, make a long-handled tamp as shown. The hardware cloth (wire mesh) pushes the stones down, leaving the finer-grained concrete on the surface, after which it is smoothed with the wooden float.

When both halves of the court have been poured and leveled, and while the material is still green, remove the center forms and insert

expansion joint material, or tarred felt strips, and fill in the necessary concrete. An expansion joint also must be installed across the court directly under the net line. In warm climates, however, only one expansion



joint is necessary. By using two of them to divide the concrete into four slabs, some movement in winter is permitted without cracking. If the soil beneath the court is not well drained, a 6" gravel or cinder fill could be made before pouring the concrete.

After the job is done, keep the concrete wet for at least a week by sprinkling it two or three times a day. If exposed to very hot sunlight, cover with burlap or similar material, which should be kept moist. The ultimate strength of the concrete depends a great deal upon this treatment.

Do not paint the border lines until one month after the concrete has been laid, otherwise the chemicals in the material will blotch and disintegrate the paint. Special paints for this purpose are available, but regular traffic-line paint is also used. To do a neat job, mark the boundaries with chalk line, then do the painting through a guide as shown in Fig. 7. Use a so-called "tooling brush" of the 2" size.

Light standards can be made of galvanized-iron pipe, and they will also serve as posts for the net. Several types of lamps are satisfactory, but they should be located properly and be of the correct height for

Boat Registration Papers Protected in Celluloid

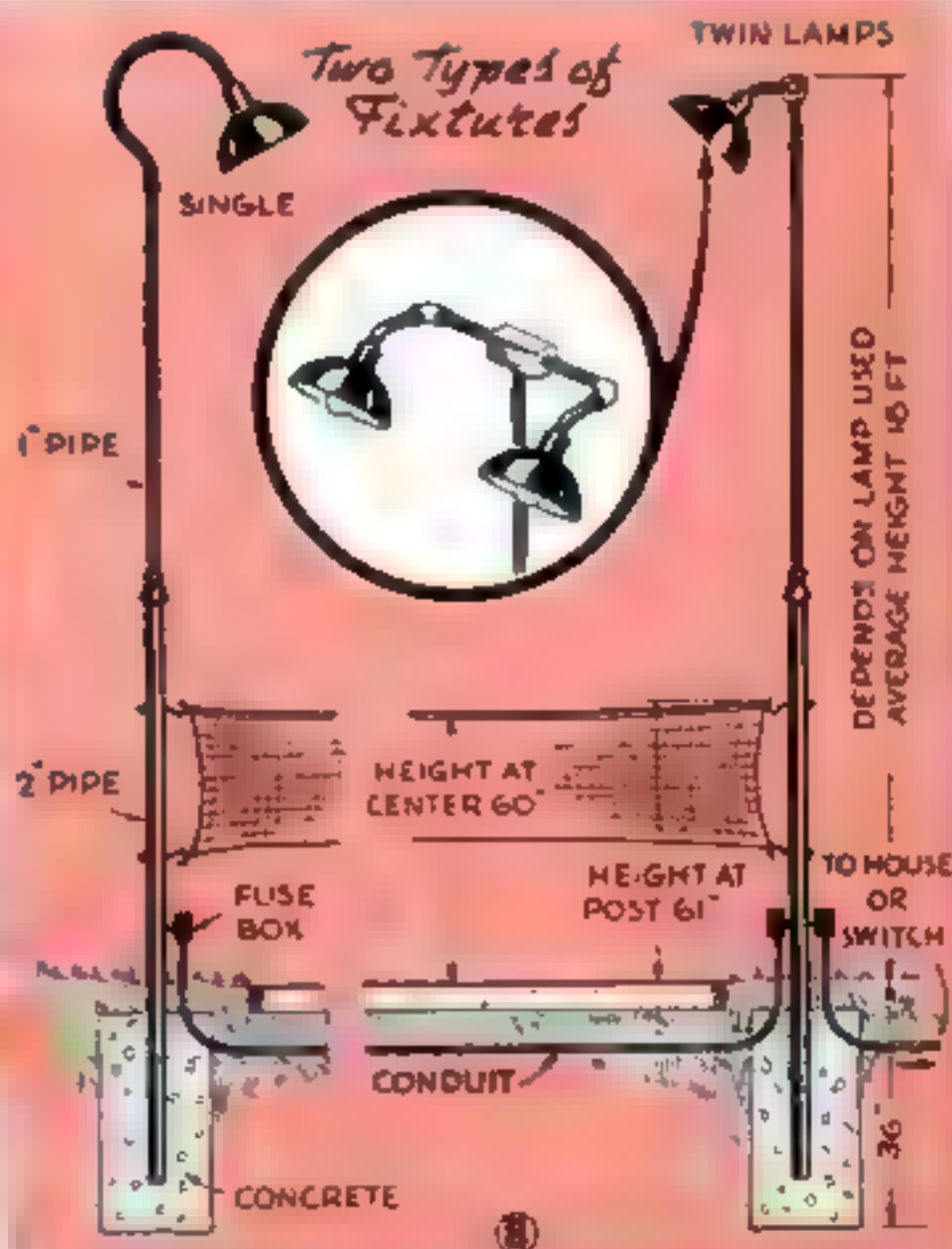
BOAT registration papers can be kept flat, clean, and dry in a celluloid picture frame of the type sold in ten-cent stores. Another and even better wrinkle is to obtain a couple of pieces of clear celluloid of adequate size and sandwich the registration form between them, sealing the edges by brushing a narrow $\frac{1}{4}$ " strip all around on each inside surface with acetone or amyl acetate, obtainable at almost any drug store. This makes a case which is completely waterproof.—A. C. GOULD.

best efficiency. The local light company will test them for proper height. A typical installation is shown in Fig. 8.

Hedges, shrubbery, and trellises will improve the appearance of the surroundings and make the court an asset to the property. The ground should slope away from the court slightly, or adequate provision must be made to carry off rainfalls. Otherwise, time may be wasted waiting for the puddles along the edges to dry up.



The top of the net at the post should be 61" above the court, and at the center of the net, 50". At right, a typical installation of lights if the court is to be used at night



Unique TAILLESS

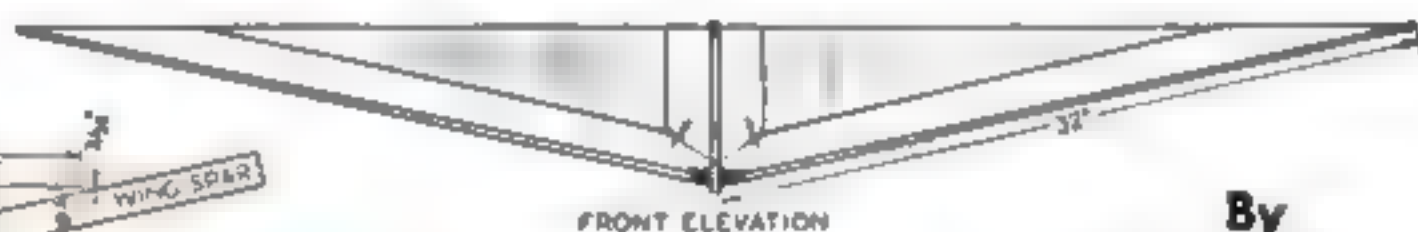
RIGGED LIKE A RACING

"FOUR WINDS" is an unusually satisfactory type of tailless kite based on the results of recent research into the aerodynamics of yacht sails. The design utilizes the highly efficient sail plan of a Marconi-rigged racing sloop for each of the wings of a two-stick tailless kite. It carries a steep line and flies steadily through a wide variety of wind velocities.

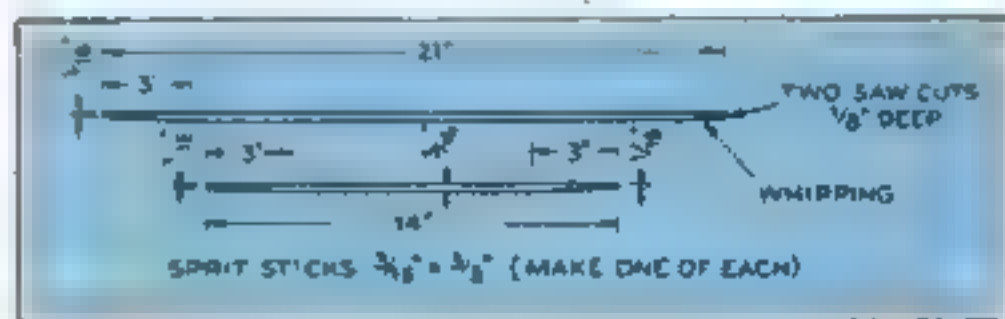
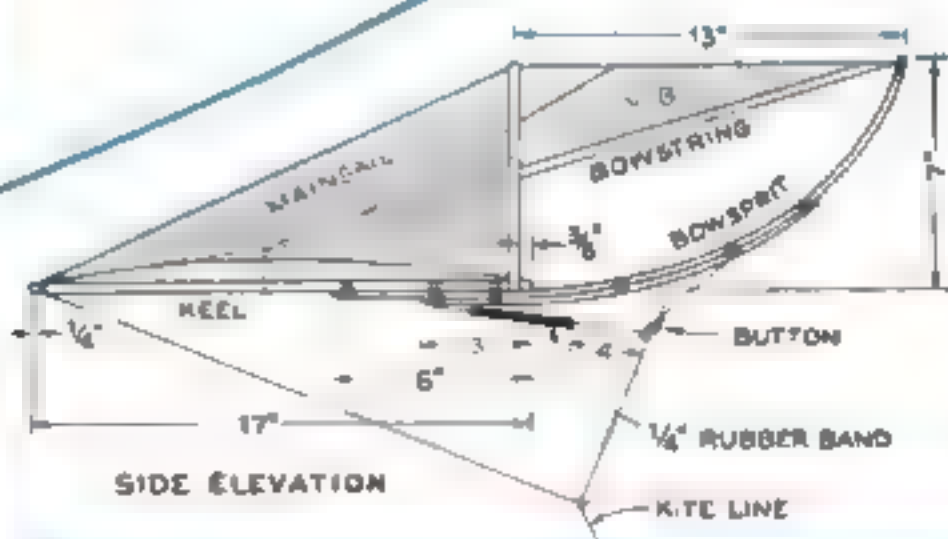
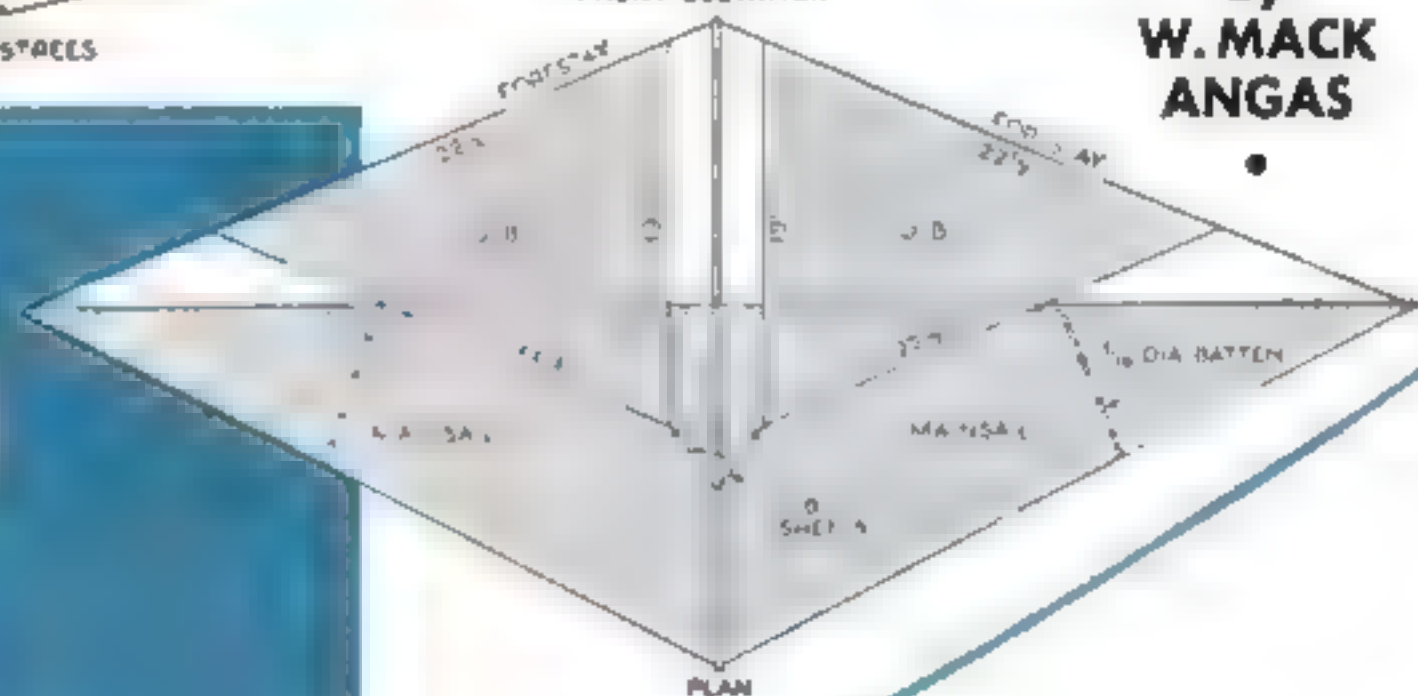
Straight-grained spruce is the best wood for kite sticks, but any well-seasoned and reasonably strong, straight-grained, light

wood will do. The $\frac{1}{16}$ " diameter battens are 8" softwood applicators from a drug store. Additional materials needed are 2 yd. of light cotton madras or broadcloth, which must be 1 yd. wide; 50' of light, strong fish-line; a tube of quick drying cellulose cement, and some heavy pins. A couple of dozen spring clothespins will be found useful for holding the fabric in place when the sails are being made.

The sticks should be prepared as shown. Then glue and lash the wing spars to the



By
**W. MACK
ANGAS**



KITE

SLOOP

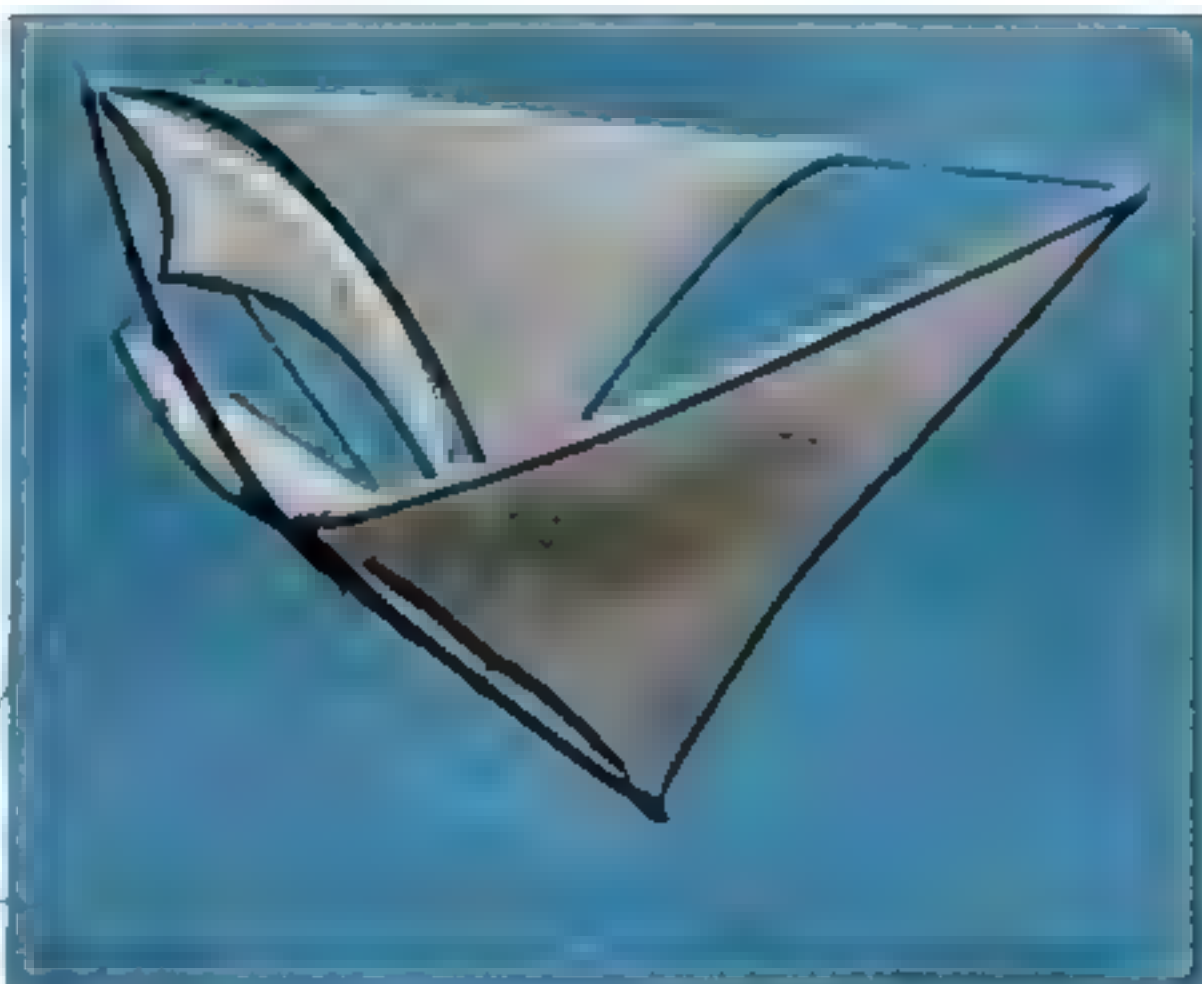
crosstree or joint connector, and fasten the crosstree to the keel with a long, heavy pin. Be sure that the crosstree and wing spars are at right angles to the keel. Before putting the frame aside to dry, give all the lashings a liberal application of cement.

Attach the bowstring to the after end of the keel and lead it up through the vertical saw cut in that stick. Form a small loop 8" from the end of the keel for the attachment of the jib sheets or cords. Leave the bowstring of sufficient length to reach the forward end of the bowsprit.

Cement and lash the long bowsprit under the keel; then set the short sprit stick in place and put on the next two lashings, but do not put on any of the lashings forward of the crosstree. Now bend the long sprit stick by means of the bowstring until the tip is 7" above the keel. Finally, put on the three remaining sprit lashings to bend the short stick to the curve already taken by the long stick. Don't attempt to make the bowsprit merely an extension of the keel or the kite will tend to nose dive.

Rig the kite frame with two 48" lengths of fishline to form the backstays and a single length to serve as the forestays.

In covering the kite, the mainsails are put on first. Do not wrap the cloth around the spars; simply fasten it to their upper surfaces with a smear of adhesive about $\frac{1}{4}$ " wide and clamp in place with clothespins. Now lay the material loosely over the backstays, trim away excess cloth, and cement the hem down over the stays. Do not fasten the two mainsails to the keel; let them overlap a little and fasten them together with adhesive. The sails should be loose.



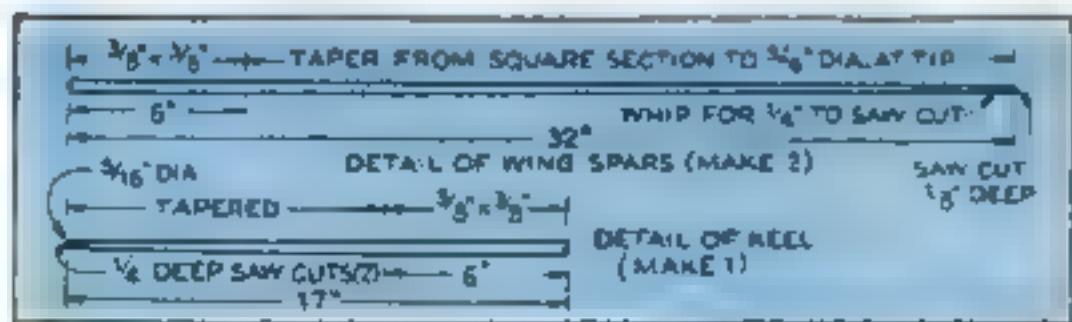
She's up! This kite can be raised right from the hand without running and flies steadily in a wide variety of wind velocities

Mount the battens with a few stitches and a smear of cement.

The jibs should be made to a paper pattern of the dimensions shown. Form a 1" loop in a piece of fishline by tying a bowline and leave the ends 18" and 22 $\frac{1}{2}$ " long; these are cemented into the hems along the foot and leech of each jib. The loop is left free for the attachment of the jib sheet. The jibs are cemented to the forestays. Secure a short piece of fishline to the loop in the bowstring and run the ends to the loops in the after corners of the jibs as indicated. These lines, the jib sheets, should be tied with knots that can be readily loosened to alter the adjustment. Run a short line from the loop in the bowstring through a hole in the mainsail to the keel and draw the bowstring closer to the keel so as to permit the jibs to be trimmed very flat if necessary.

The brace or bellyband is rove through a bone button to a $\frac{1}{4}$ " rubber band as shown; and the button is secured by a short length of line to the bowsprit. The brace slides through a hole in the button, which permits the effective length of the forward part of the brace to increase in a high wind.

Attach the line to the brace about 8" forward of the end of the keel when the rubber band is barely tight. Set the jib sheets so there is a little slack in them and the same amount in both. Try the kite in a light breeze. If sluggish, move the kite line forward $\frac{1}{2}$ " and slacken jib sheets a little; if it flies unsteadily do exactly the reverse.



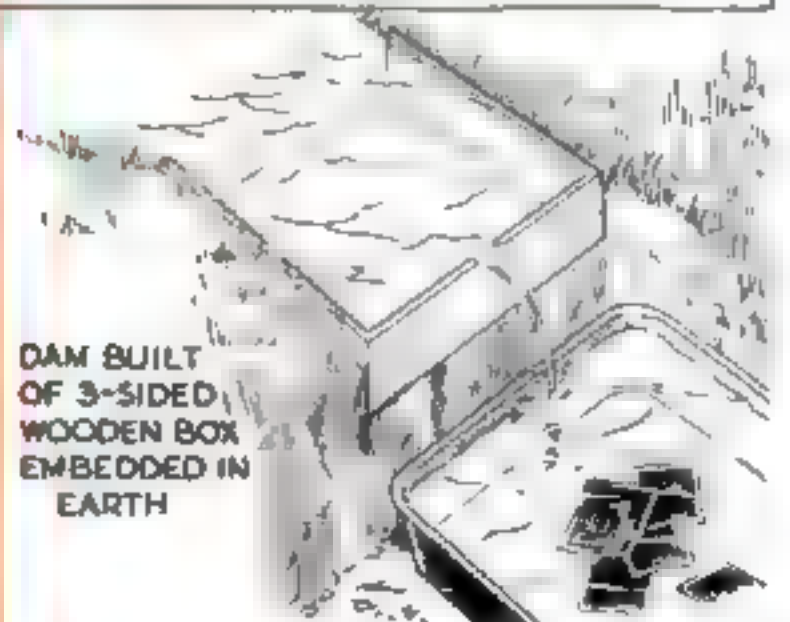
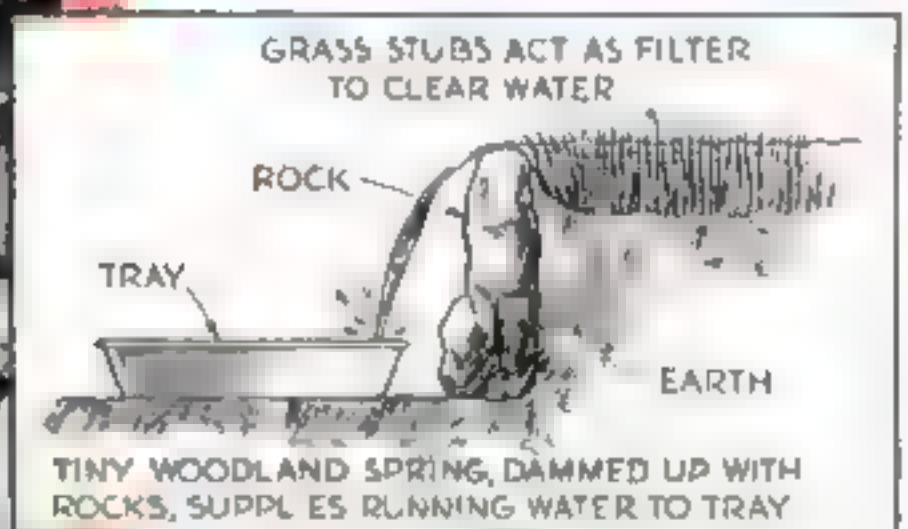
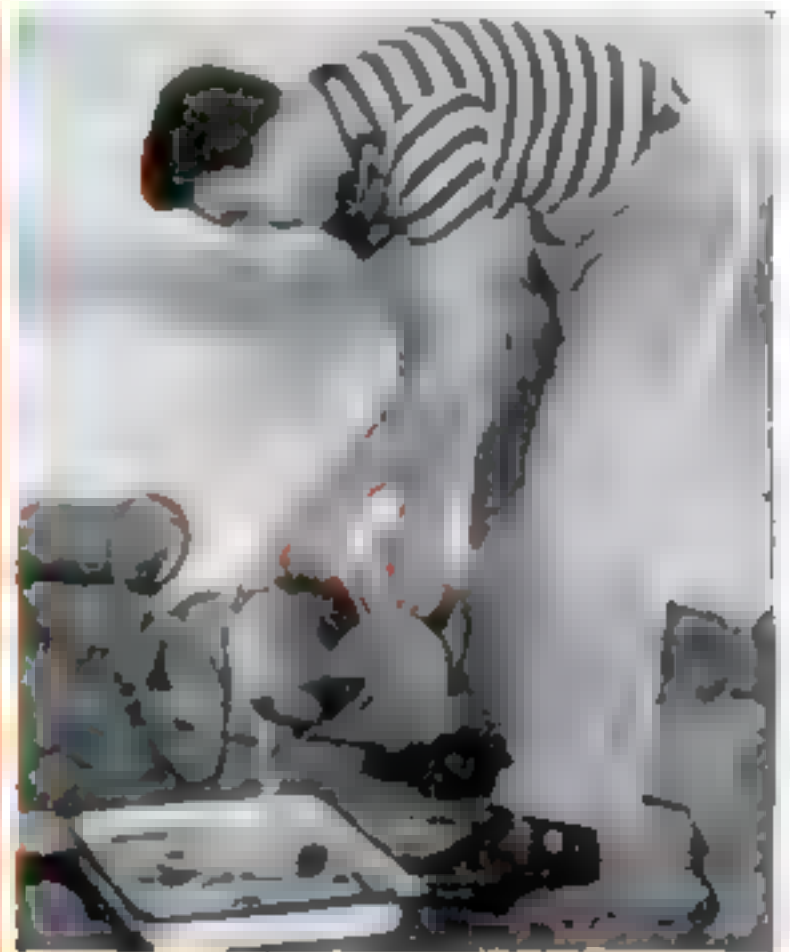
Developing and Printing

AMONG the advantages of developing and printing your photographs at camp are the satisfaction of seeing finished prints immediately and the opportunity of checking your exposures. You make certain of taking back with you an interesting photographic record of your camping activities.

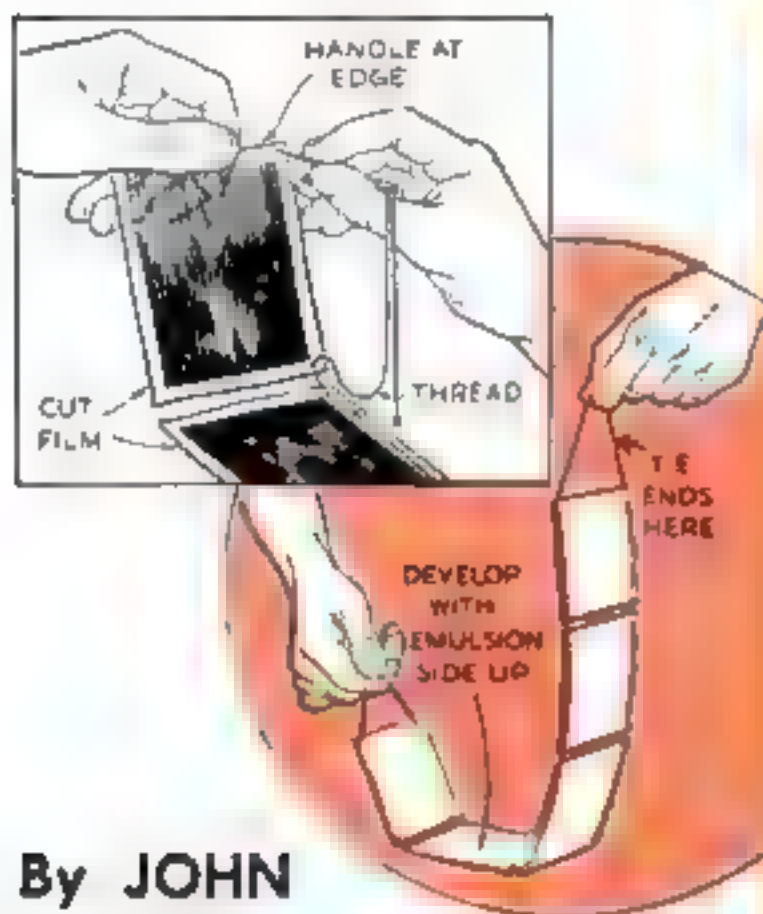
Simplified, lightweight equipment goes a long way toward making the job a pleasure. Choose a slow, rather than a fast, developer. By doing so, you not only reduce the danger of under- and overdevelopment, but also give yourself the time to employ tray developing with safety. Thus the need for carrying negative tanks, film holders, and related accessories is eliminated. If your camp is not shaded by trees, develop on moonless nights.

Use the same set of trays for negative developing that you use for prints. In order to handle quantities of cut film with safety,

you may string them on a piece of thread with a sewing needle, as shown in two of the sketches. Films are easily joined together in this manner while dry, and a batch of them can be put through the developing, hardening, fixing, and washing baths as



Your Pictures at Camp

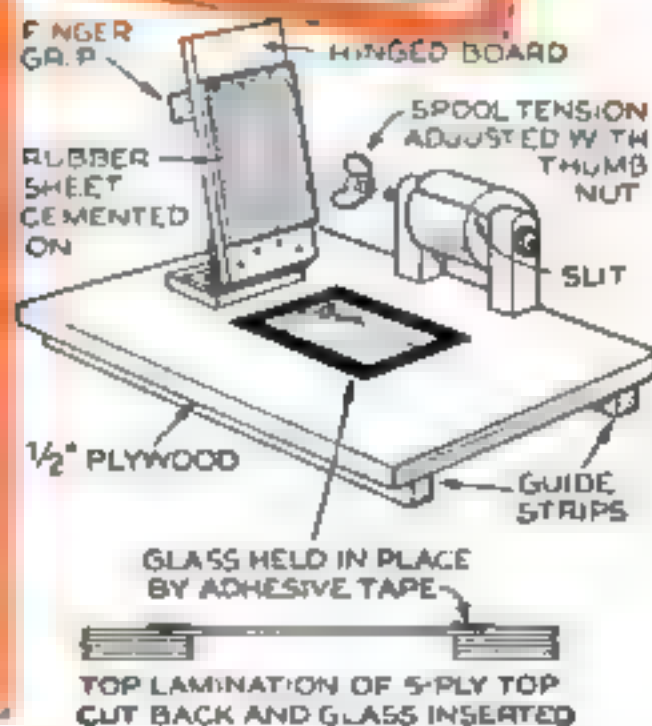
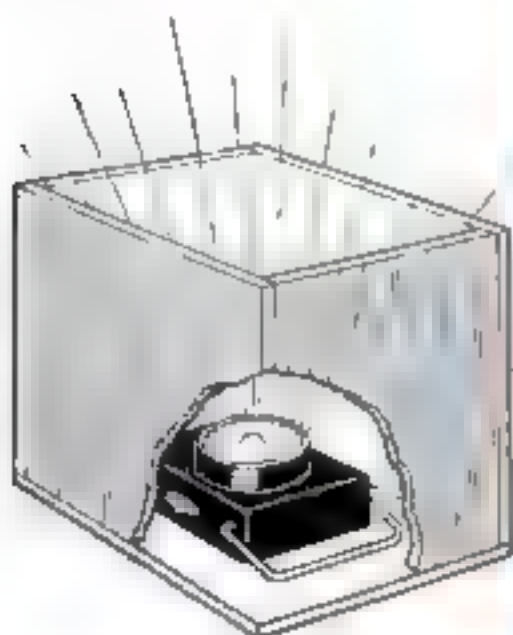


By JOHN MODROCH

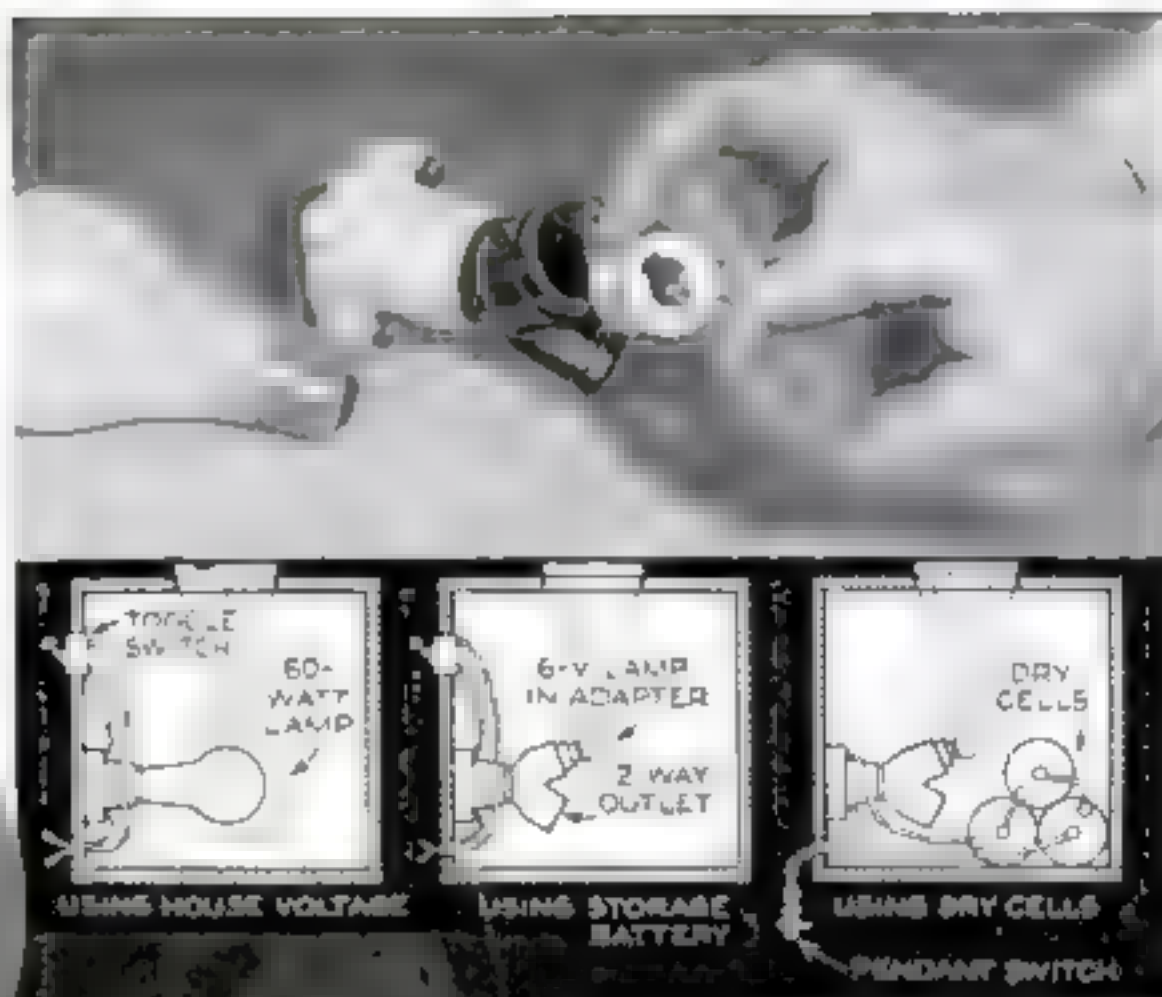
though they were a strip of roll film.

An example of a piece of versatile equipment is the simply made printing box illustrated, which also serves as a safelight. Cut negatives can be printed safely by means of the rubber-cushioned, hinged board. Film strips, when wound on the spool and unreeled as printed, are prevented from lashing about, and in this way they are safe-

Cut films can be strung on thread for convenient tray development. The utility box serves as a safelight as well as for all types of printing



At right, how a two-way socket plug is used to center a small lamp in the printing box. The diagrams give three arrangements. In circle, even the cells of your flash gun can be connected with the printer if no better source of power is available. The lower photograph shows a negative being placed on the glass window of the box all ready to be printed



guarded against scratches and tears.

Test prints of 35-mm. negatives can readily be made with the aid of this device by winding both the negative and a strip of 35-mm. print paper on the spool together. Make the exposure for each frame separately, and the positive strip can be developed, negative fashion, as a roll.

Although printing masks may be used with the printer, dispense with masking in the interest of simplicity. The absence of white borders on the prints need not detract from the effectiveness of pictures. They may be composed just as well, if not better, by artistic trimming done after they are dry. For this purpose, a small dime-store metal square can be used to advantage. Of course, printing frames can be used with the box, if desired, by removing the cover and holding them over the open top.

Dry cells, storage battery, or house current can be used to light the printer. A miniature-to-standard socket adapter will permit a quick change-over from house-voltage lamps to those of battery voltage. As illustrated in one of the photographs, an ordinary two-way socket plug can be used

as an extension for centering a battery lamp in the box.

Where absolute minimum weight of equipment is the deciding factor, flash-light cells may be used as a power supply, and the printer plugged into the socket of a flash gun, as shown in another photograph. Their use is not recommended, however, for quantity printing or the printing of very dense negatives. The best policy is to carry as much battery power (standard dry cells or storage battery) as your luggage allowance

permits. Then use the highest candlepower lamp that the battery will light. Where possible, the storage battery in your car can be made to light the printer, and also run a lightweight pendant safelight.

To make the printing box serve as a safe-light for developing negatives, either replace the clear bulb with a colored one of the proper type to suit your negative emulsion, or tape a colored gelatin filter over the glass opening.

Solution bottles can be eliminated by using dry chemicals exclusively. Complete assortments can be bought ready for mixing with water at normal temperatures. Developers are available in both tube and tablet form. Acid fixing baths can be prepared from convenient-sized, two-container packages of dry chemicals. A good short-stop and hardening bath for negatives and prints can be made by dissolving a tea-

spoonful each of powdered sodium bisulphite and granulated potassium chrome alum in a pint of water.

Prints can be washed in comparatively small quantities of water so long as plenty of time is allowed for the process. A search in woods and on hillsides will often reveal tiny springs that usually go unnoticed. By damming one of them up as shown at the beginning of this article, a steady, though small, stream of water can be made to drop from the spillway into washing trays. A flow even as small as the thickness of a pencil will suffice if several hours are allowed for washing.

Dumping should be employed systematically when washing prints with water that has to be drawn by means of a pail from lakes, wells, and similar sources. Depending on the size and number of prints in the

batch, the water in the tray should be changed a dozen times or more. A few minutes should be allowed between changes, while the tray is being agitated.

As an expedient for eliminating as much hypo as possible with each change, the prints should be individually lifted out of the tray and drained before being put back in the refilled tray. Frequently rinsing the hands will also help to lessen the hypo carry-over with each change. A small piece of viscose sponge is handy for wiping off negatives and prints when removing them from the washing bath.

Glossy, ferrotyped prints bring out negative detail to the best advantage. However, if ferrotype tins cannot conveniently be included in your equipment, matte or semi-matte printing paper may be used. For drying matte prints, a book of blotters is best.

Easy Way to Tell When to Discard a Developer

INSTEAD of keeping a record of the number of rolls of film developed in a quart of developer or relying on my memory so that I won't use the developer after it has reached the point of exhaustion, I have a simple system that requires no chart or mental calisthenics.

I use a 1-qt. bottle of developer and keep exactly enough replenisher for that quart in another bottle. When the replenisher is used up, I know the developer has passed its peak of usefulness. For example, the manufacturers of the developer I use (DK 20) recommend the processing of about twenty rolls of film (size 2 1/4" by 3 1/4") in my developer if 1 oz. of replenisher is added after every roll processed. I therefore put 19 oz. in the replenisher bottle. After every roll I pour 1 oz. of replenisher into the developer bottle. Enough developer is used up each time to make room for this in the bottle.—WALTER GOTTJES.

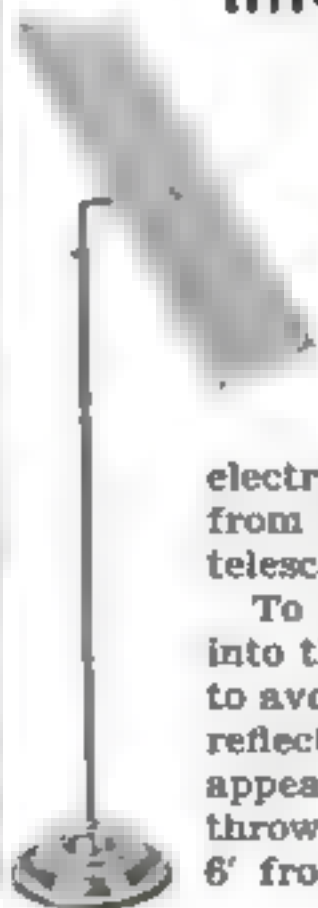


Old Ferrotype Tin Converted into a Tilting Reflector

BY MAKING use of a discarded 14" by 20" black ferrotype tin and an obsolete window display stand, I built an adjustable reflector for indoor portraiture and movie making.

The ferrotype tin was rubbed to a dull finish and given two coats of aluminum paint. It was then fastened to the stand by means of a ball-and-socket electrical fitting. The reflector may be raised from 34" to 63" from the floor by means of the telescoping rod that came with the stand.

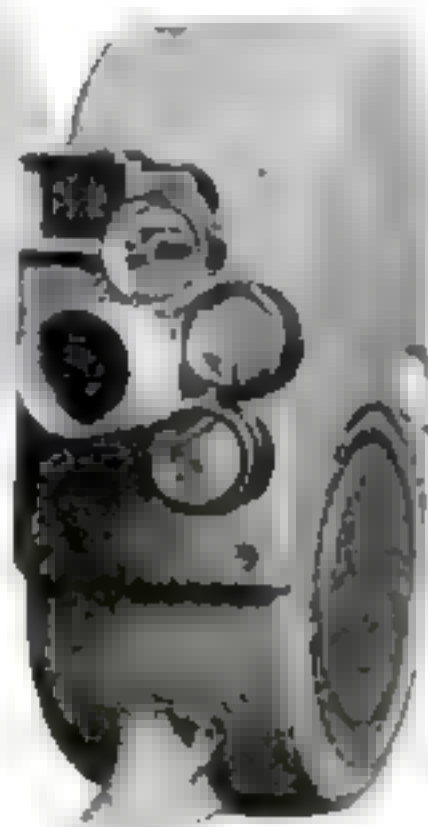
To adjust the reflector, a pencil is inserted into the opening at the center as shown in order to avoid handling and marking up the aluminum reflecting surface. Although the reflector may appear comparatively small, it will actually throw an 8' by 10' reflection when placed 6' from the subject.—ARTHUR TRAUFFER.



Supplementary Lenses and Filter Mounted on Camera Sunshade



The sunshade is normally left in place as at the right, but if a close-up has to be taken or the yellow filter used, the change can be instantly made



sharp close-ups from 8" to 24" or farther, and the portrait lens from 2' to 10' or 15'. Allowance must be made for finder parallax when making extreme close-ups.

To assemble the units, about one third of the outer diameter of the lenses were scraped clean of enamel and the surface cross-hatched with a file. The brass tube was also deeply cross-hatched over the required area. A thin coat of high-grade liquid glue was applied and allowed to dry thoroughly. A heavier application of glue was then given, and the four elements were arranged on a piece of writing paper and pressed together when the glue became tacky. Two small, triangular pieces of lead, cut from an ordinary BB shot, were roughened by notching with a knife blade and given the same thin glue treatment. These were then heavily coated with glue and pushed into the two triangular openings between the lenses and tube. The glued assembly was allowed to harden overnight, and the next day every crevice in the assembly was filled with glue and the whole unit allowed to set about forty-eight hours. The paper base was then stripped off.

CLOSE-UPS add interest to amateur movie films, but to get good ones generally requires a costly focusing lens or bothersome supplementary lenses. Instead, a neat accessory unit may be made as illustrated. Two inexpensive supplementary push-on lenses, one a portrait and the other a copying-type lens, and a medium yellow filter are mounted side by side around a $\frac{3}{8}$ " length of brass tubing, which serves as a sunshade.

Even at a full $f/3.5$ aperture, the supplementary lenses provide sufficient depth of focus for off-hand shooting. The copying lens with an 8-mm. camera will allow wire-

the glue became tacky. Two small, triangular pieces of lead, cut from an ordinary BB shot, were roughened by notching with a knife blade and given the same thin glue treatment. These were then heavily coated with glue and pushed into the two triangular openings between the lenses and tube. The glued assembly was allowed to harden overnight, and the next day every crevice in the assembly was filled with glue and the whole unit allowed to set about forty-eight hours. The paper base was then stripped off.

A more durable mount could be made by soldering, but such work would have to be done very carefully.—ALVIN J. BRAULT.

COLOR FILMS—Daylight Exposures

[PHOTOGRAPHY]

| | Bright Sun | Hazy Sun | Cloudy-Bright | Cloudy-Dull |
|------------------------|------------|----------|---------------|-------------|
| Light-colored subjects | $f/8$ | $f/5.6$ | $f/4$ | $f/2.8$ |
| Dark-colored subjects | $f/5.6$ | $f/4$ | $f/2.8$ | $f/2$ |

Kodachrome—Regular, or Type A with daylight filter, use above lens apertures at $1/50$ sec.; Professional Daylight Type, $1/25$ sec.; Professional Type B with Wratten No. 85B filter (not recommended for daylight but can be used), $1/25$ sec., but open diaphragm slightly more than settings given above.

Dufaycolor—Daylight roll film, or Daylight cut film with 1D filter, use above lens apertures at $1/50$ sec.; PF type with 1PF filter, $1/25$ sec. (Dufaycolor recommends larger apertures for winter work.)

Note: With a shutter speed half as fast, the next smaller aperture can be used. Example: Regular Kodachrome at $1/25$ sec., use $f/11$ instead of $f/8$, $f/8$ instead of $f/5.6$, etc.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Sliding-Block Puzzle

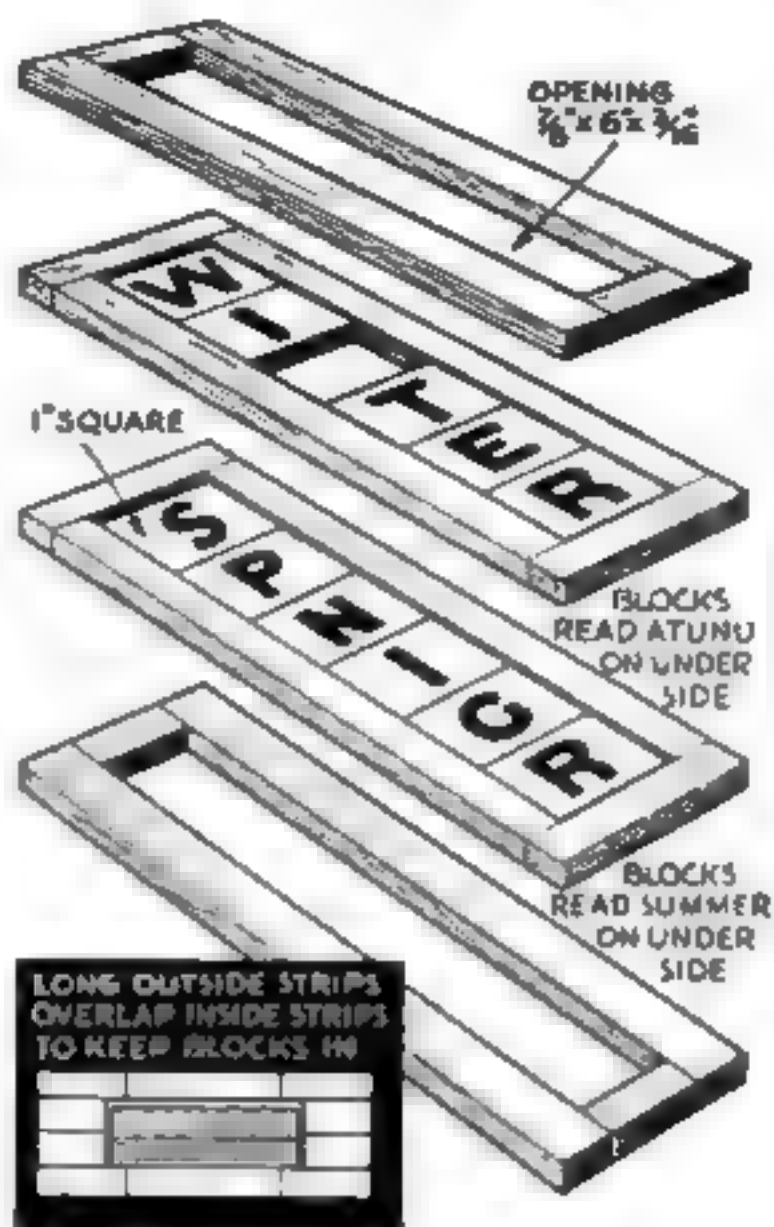
SPELLS THE SEASONS

"CHANGE THE SEASONS" is a sliding-block puzzle in which the letter blocks have to be moved about so that SPRING takes the place of WINTER and AUTUMN the place of SUMMER.

The puzzle consists of eleven thin, square blocks of any convenient size with a letter on each side as follows: (1) WA (2) IT (3) TU (4) EN (5) RU (6) SS (7) UP (8) MN (9) MI (10) EG (11) RR.

These blocks, after their sharp edges have been sandpapered slightly, are permanently inclosed in a case, which may be made of strips of the same material. The long strips on top and bottom overlap the inner strips as shown so that the blocks will be held in. Care must be taken in gluing up the case not to glue the long outside strips fast to the blocks. The end strips may be all of one width.

It is important to place the lower layer



The eleven sliding blocks are placed as at the left when assembling the puzzle

of blocks as indicated, so as to read SUMMER on bottom and SPNIGR on top. It is possible to get the wrong E and R for SUMMER, making an impossible combination to solve. The top layer of blocks reads WI-TER on top and AT-UNU on the bottom. The N of WINTER is furnished by the N on the back of an M block of SUMMER. When solved, the N of SPRING is similarly furnished by the N on the back of the M block of AUTUMN. The blocks shown are 1" square.—ARTHUR L. SMITH.

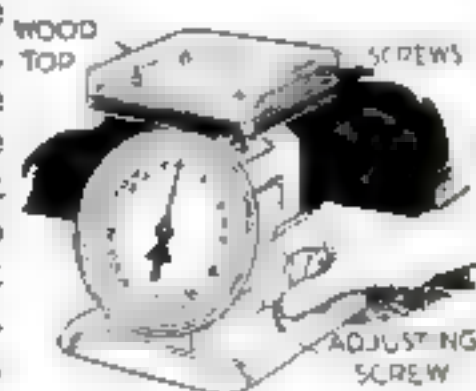


Ammonia Removes India Ink

MANY amateur and student draftsmen are unfamiliar with the old but useful stunt of using ordinary household ammonia to remove waterproof India ink from ruling pens and other drawing instruments. Apply the ammonia with a small brush, then wipe the instrument clean with a cloth.—W. E. B.

Worn Household Scales Given Better Action

HOUSEHOLD scales after several years' use are likely to become sluggish. To improve them for ordinary home use, put a weight on top such as a board cut to the size of the top of the scales and weighing about 1 lb. Then adjust the set screw back to zero. You will notice a distinct improvement in the action of the spring. For postal scales, use a 1-oz. weight in the sameway. The weight should be attached to the scales so that it will always be in place.—J. S. MOORE.



By
ALAN ORTHOF
and
NICK LIMBER

RACING-TYPE



Fast is the word for this model. It is 24" long, built of plywood, and driven by a small gas engine.

SLEEK ships powered with small gas engines are to be found racing wherever model-boat skippers meet. Keen competition in this rapidly developing sport has resulted in the development of many intricate hull designs. Sea sleds, however, have been found to operate satisfactorily and have gained great popularity because of the ease with which they can be constructed.

The model illustrated cost approximately five dollars for materials, not including the power plant. It will take any gasoline engine of from 1/7 to 1/5 h.p. The boat comes under the class "D" race ruling, and has been clocked at 22 m.p.h.

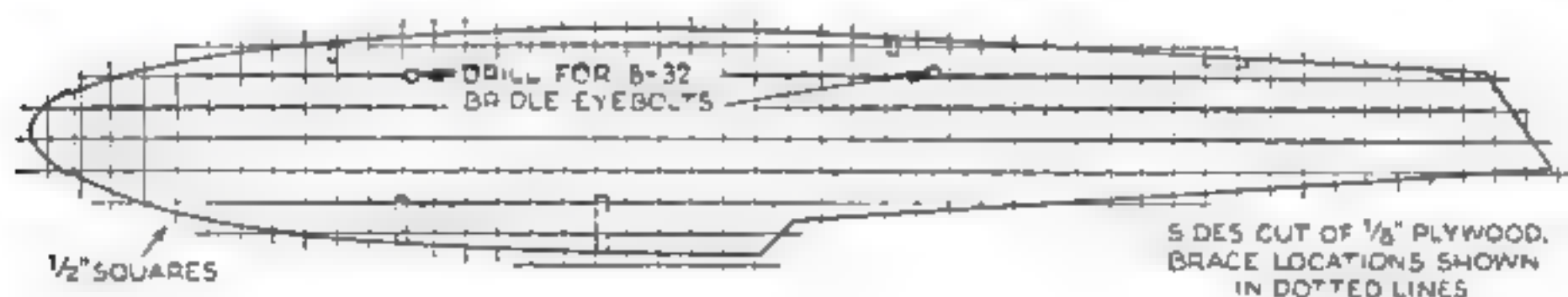
Cut two identical side panels from 1/8" waterproof three-ply wood. Clamp them together and finish the rough outline with sandpaper. Drill holes for the bridle eye-

bolts. Pencil in the locations of the cross braces.

Shape a bow block from 7 1/4" by 1 1/4" by 3/4" basswood or pine as indicated in section A-A. Coat the ends liberally with casein glue and attach the side panels. Drive 1" brads into the joint for additional strength.

The cross braces and transom are cut from 1/4" three-ply wood. They are 7 1/4" long, and the height of each may be determined by referring to section A-A. Each is attached to the side panels like the bow block. When the glued joints have dried, the bottom of the boat is planked with 1/16" waterproof three-ply.

The section forward of the main step is composed of three panels so as to form two secondary steps as indicated in the perspective sketch of the hull. Note that each section overlaps and that shims are used to retain the shape of the side panels. Aft of the main step, the craft is planked with a single panel. All planking is laid on top of the side sections and cemented with casein glue. Pins are used to hold the planking to the structure until the glue dries. At this point give the interior of the hull several coats of spar

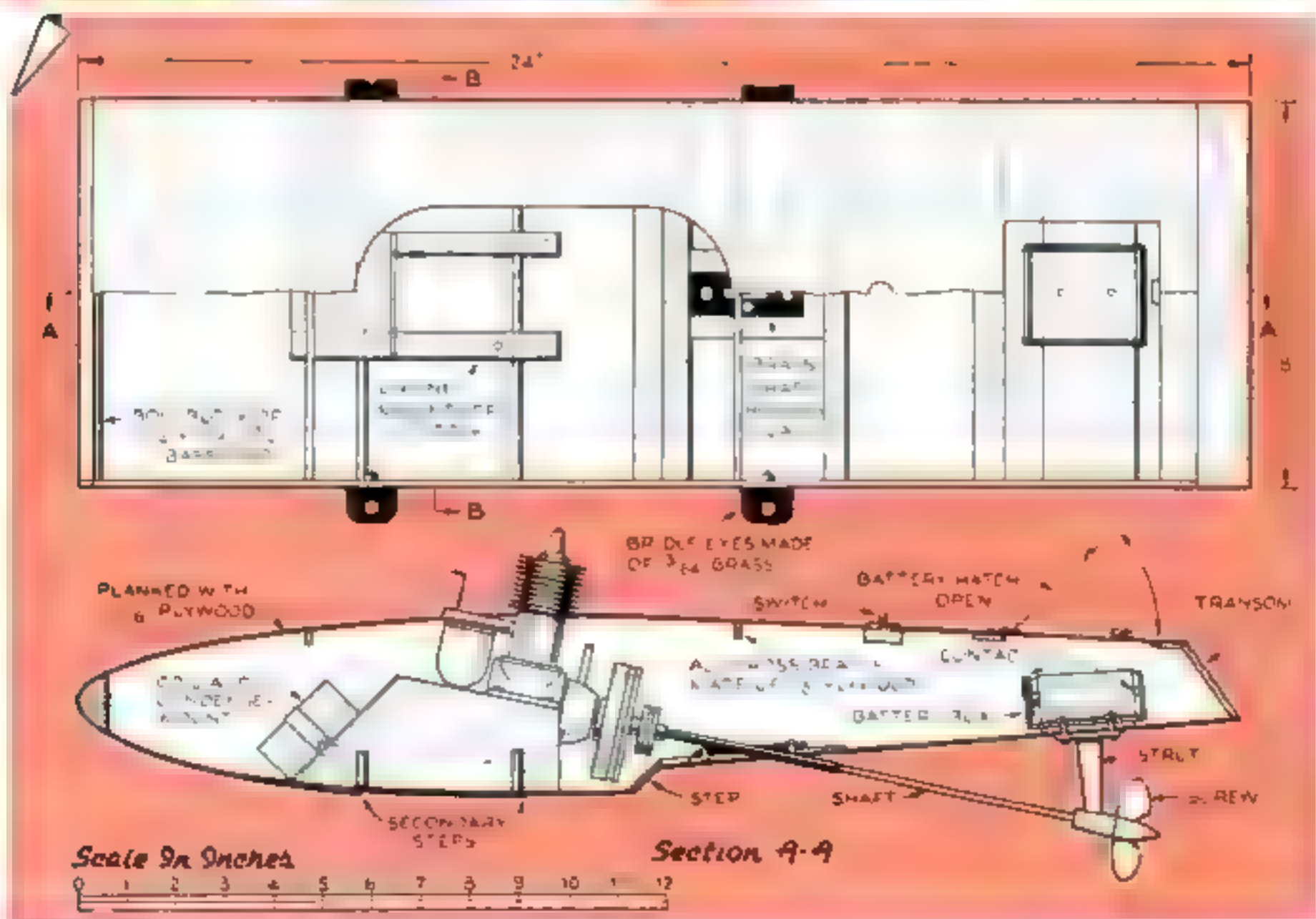
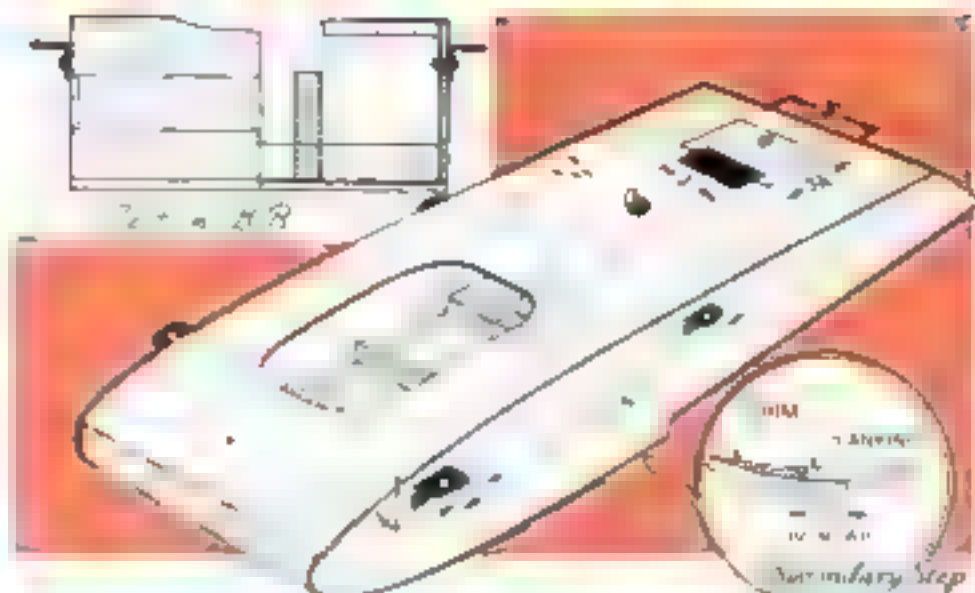


MODEL SEA SLED

varnish, and allow to dry thoroughly.

Again referring to section A-A, draw the motor mount on a piece of $\frac{1}{2}$ " basswood or pine and cut to fit across the braces as shown in the plans. The angle of the top surface of the mount will naturally depend upon the type of engine used and the size of the flywheel. The screw, strut, and shaft housing sizes will also depend upon the engine. Before constructing the engine mounts, buy metal fittings expressly designed for the engine being used.

After the engine mounts have been in-





Installing the engine. At right bow view of the completed boat; also wiring diagram and shaft fittings



stalled, drill a hole in the bottom of the boat for the shaft housing. Slip the housing into place and screw it to the cross brace. Plastic composition wood is stuffed between the shaft housing and the hull planking. Bolt the strut to the rear cross brace and also attach the battery box. The latter may be made of wood, or a metal one may be bought.

Bend four bridle eyes of $3/64$ " brass and bolt to the sides of the boat. Attach the coil and condenser to the motor mount panel and fasten the engine in place. Attach the switch as indicated.

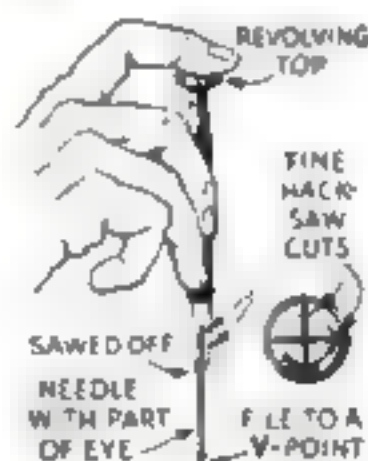
Trace the deck of the boat on a $1/8$ " three-ply panel. After cutting out the engine and battery hatch, glue the deck to structure. A cover is made for the battery hatch of the same material as the planking and attached to the boat with a brass hinge. Fasten a small handle to the cover. This may be shaped as a teardrop section and held in place with cement and a bent pin.

Sandpaper the boat thoroughly and apply several coats of waterproof mahogany varnish stain to the outside. After each coat has dried, rub down the hull with very fine sandpaper. Leave the last coat in the full gloss.

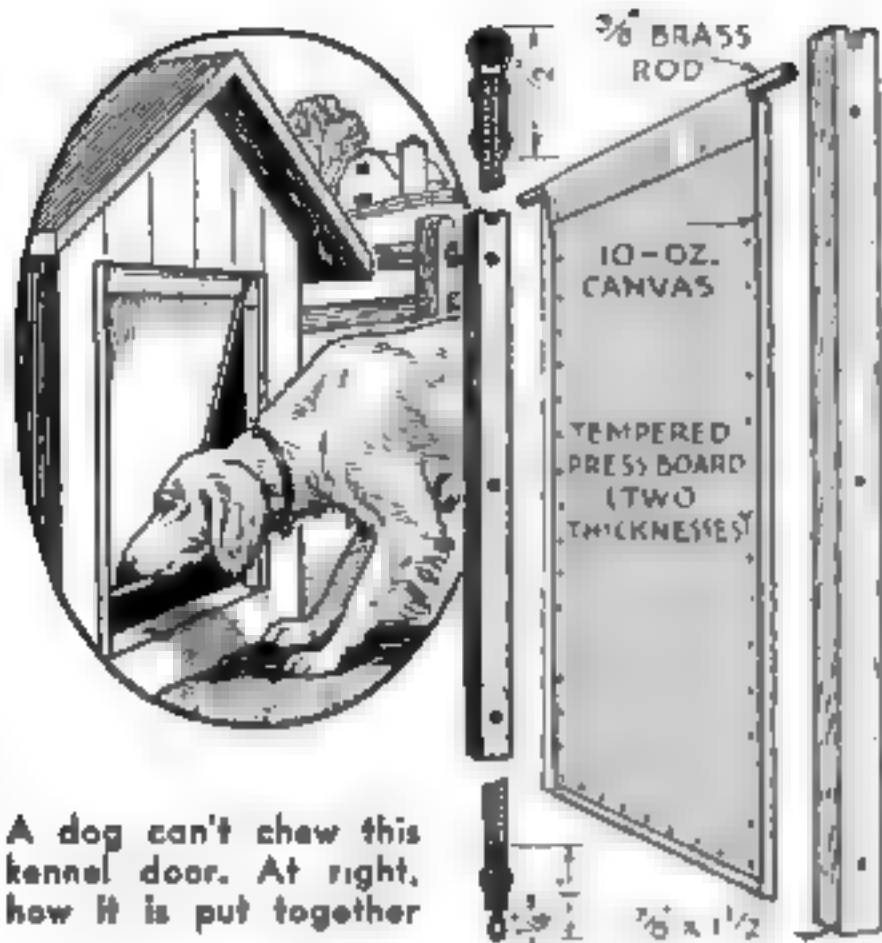
In racing the craft, the bridle hooks are attached to the bridle eyes at the side of the hull. A leather thong of sufficient strength is used to fasten the hooks to a strong cord. The cord must be of sufficient length so that

the circumference of the boat's course will be the number of yards desired. By varying the length, the distance the boat covers in one lap may be changed according to any racing regulations. The end of the cord is, of course, held by the boat's skipper.

Model Maker's Pin Drill



MODEL makers and others who drill numerous small pinholes in wood can quickly make a drill from a small jeweler's type screw driver. The blade is cut off close, and two slots are cut as indicated with a fine hack saw. The drill is a steel sewing needle with the point and all but $1/16$ " of the eye broken off. File the other end to a V-shaped point. Insert the drill in the center of the saw cuts and bind with a few turns of fine wire. Then run a drop or two of solder into each slot. Remelt the solder to replace the drill when necessary.—CHARLES E. HARKER.



A dog can't chew this kennel door. At right, how it is put together

Swinging Door Closes Dog Kennel Tightly

A KENNEL door that stays shut, is nearly air-tight, and is impossible for dogs to chew, can be made as shown. It is much better than any kind of curtains.

The door itself consists of two thicknesses of $\frac{1}{2}$ " tempered press board, obtainable from a lumberyard. These are cut so that there will be a $\frac{1}{4}$ " space around the sides and bottom. The rougher sides of the boards go together. A piece of 3" wide sheet brass is bent over the brass rod and riveted with small copper nails to the top of the door, forming a hinge. Strips of 10-oz. canvas, $2\frac{1}{2}$ " wide, are folded lengthwise and stuck between the two boards on the sides and bottom, and the boards are then riveted together in such a way that the rivets (or nails) pass through the two thicknesses of canvas. The fold of canvas should project $\frac{1}{4}$ " all around.—WILLIAM H. FOSTER.

Suction Cups Obtained from Shooting Game

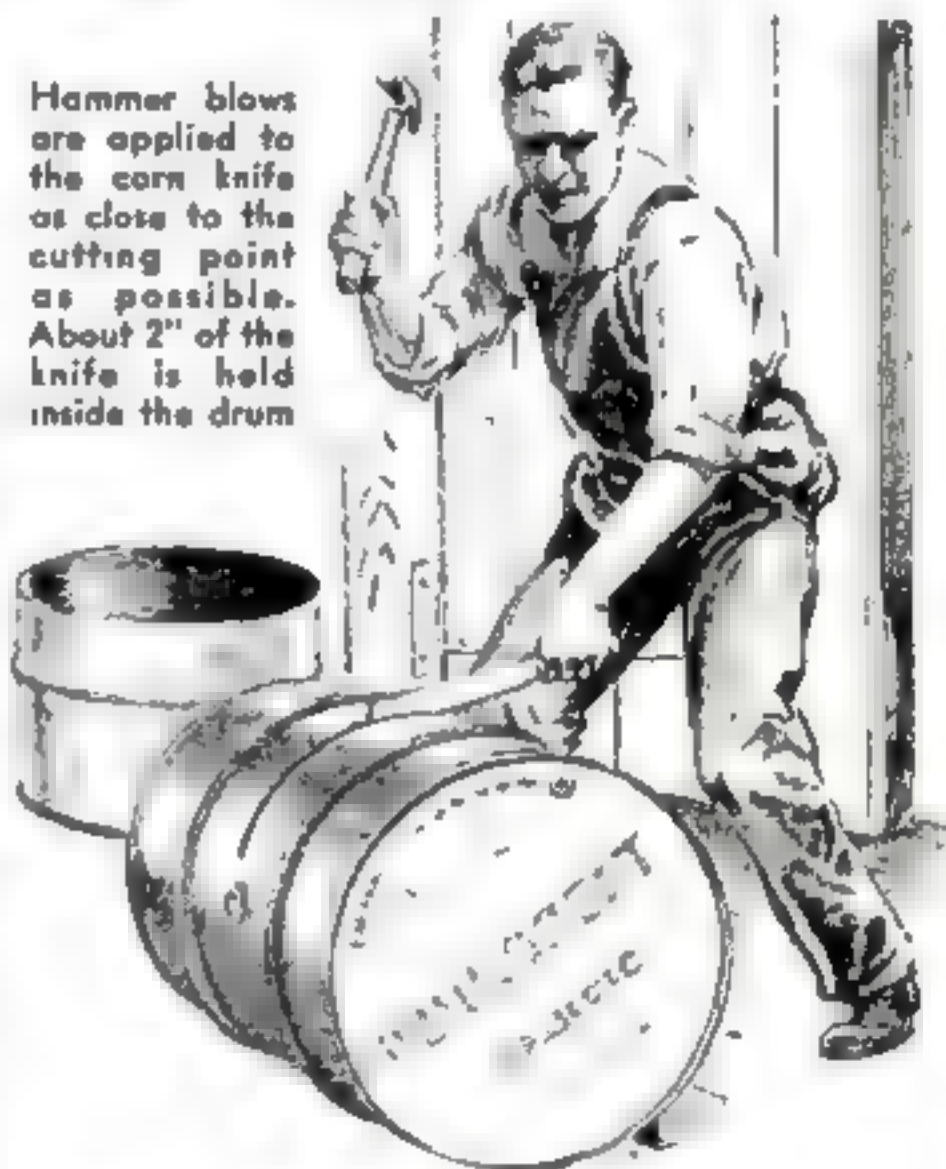
WHEN small rubber suction cups are needed and none is at hand, buy a ten-cent toy shooting game of the type having ammunition fitted with suction cups. These come in a considerable variety of sizes. The rubber cups can be removed, and the heads of the bolts substituted for the usual slender wood shaft.—O. B.



Old Corn Knife Is Used for Cutting Oil Drums

DISCARDED oil drums are used for various purposes on the farm, but it is always a problem to cut them into the most usable sections. If the drums are scribed with a pencil or nail along the desired line, a discarded corn knife and hammer may be employed. Hold the knife so that not more than 2" or 3" remains inside the drum, and apply the hammer blows as close to the cutting point as possible. In this way, straight or curved cuts may be made in fairly thick sheet metal.—G. E. HENDRICKSON.

Hammer blows are applied to the corn knife as close to the cutting point as possible. About 2" of the knife is held inside the drum



Rubber Stamp Will Print on Uneven Surfaces

TO ALTER a rubber stamp to imprint clearly on curved or uneven surfaces, pull the type strip from the stamp, attach it with rubber cement to $\frac{5}{8}$ " thick sponge rubber cut to the same size, and cement to the holder. The photo below shows the degree of curve that is possible.



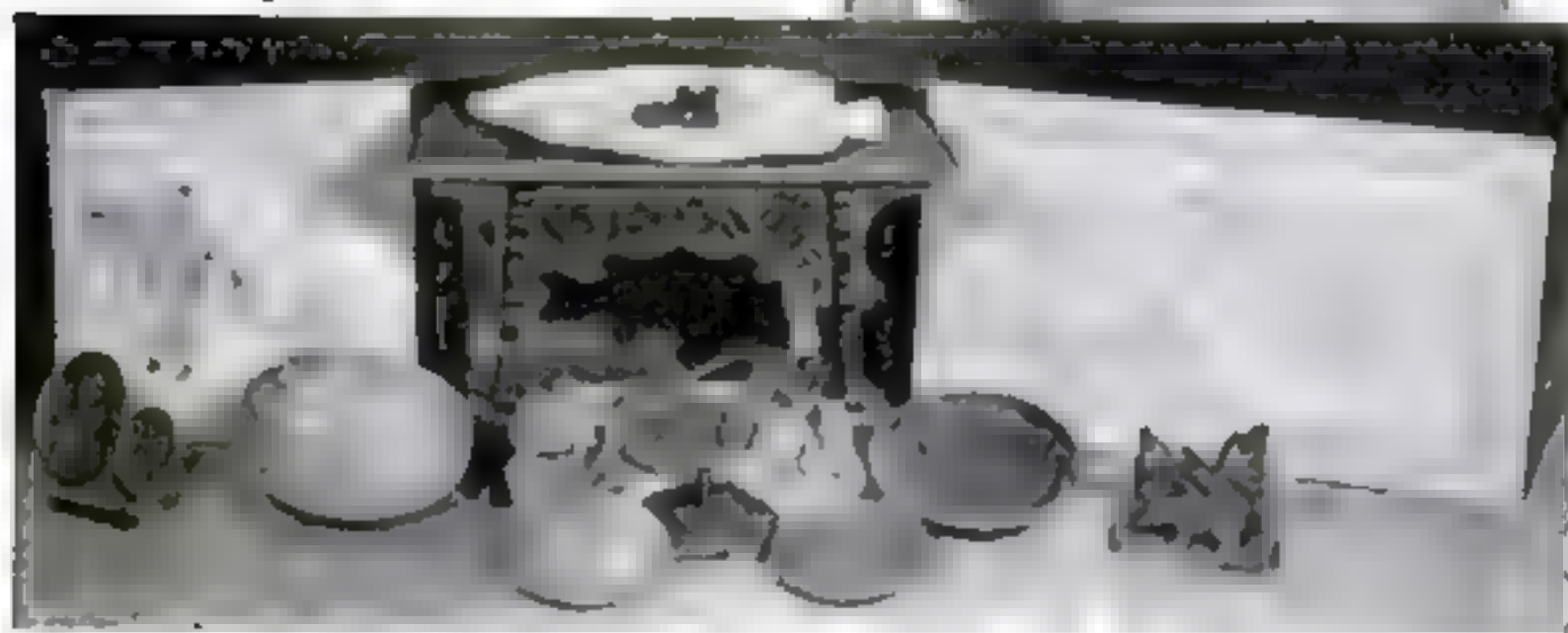


Official Magazine
POPULAR SCIENCE
MONTHLY

Miss Frances Hinkley and Miss Constance Dyar demonstrate to the men members of the St. Joseph Homeworkshop Club that they are able to do skillful craftwork



Women INVADE THE HOME WORKSHOP



A few of the projects made by the women members.

ONCE a hobby with an appeal only for men, the home workshop now is attracting an increasingly large number of women. In *St. Joseph, Mich.*, for example, women form an active part of the membership in the St. Joseph Homeworkshop Club. Under the supervision of B. L. Van Lente, of the local Y.W.C.A., they undertake all sorts of ambitious projects, and in some cases are more proficient than the men members.

Here is what some of the women are doing: Mrs. T. Nowlen is building and carving twelve dining-room chairs. Miss Mary Cunningham and Miss Harriett Bean recently completed five coffee tables and now are

working on a hope chest. Miss Frances H. Hinkley has made fifteen projects this year, ranging from wooden plates to a baby's cradle. Miss Constance G. Dyar is working on a large carved chest. Mrs. T. Gilbert, a new member, is confining her work to small projects, such as carved trays. Mrs. John Alden Bridgham will soon finish a ditty box she has been carving for her son.

Meetings are held twice a week in the manual-training room of the high school, and the women members are always on hand. When a special demonstration of metal lathe work was presented recently, the demonstrator expressed surprise at finding women present. He soon discovered,

however, that they were not merely curious onlookers.

Among the new clubs affiliated with the National Homeworkshop Guild, one of the most ambitious is the Grant Park Woodcraft Club, *South Milwaukee, Wisc.* Within a month after its organization, the members had obtained a large room and equipped it with six workbenches and a large assortment of hand and power tools. The members feel that by pooling their assets they can accomplish much more.

The Community Homeworkshop Club, *Natrona, Pa.*, is another new group that has set up a club workshop. Three power tools have been purchased and local merchants have donated \$40 worth of hand tools.

G. A. Covert exhibited his shop and things he had made when the *Portsmouth (Va.)* Homecraft Club met at his home . . . A new cut-off saw was demonstrated to the Homecraft Club of *Pittsburgh, Pa.*, at a meeting in a local hardware store . . . Louis Sakosky demonstrated metal spinning before the Gem City Homeworkshop Club, *Dayton, Ohio*, at the shop of M. H. Leander. Theodore Herbert won the club contest for the best constructed project made in recent months . . . The *Seattle (Wash.)* Homeworkshop Club held open house when the remodeled clubroom was completed recently . . . Fifty combination reading and bed tables are being made by the *Covington (Ky.)* Homeworkshop Guild for presentation to hospitals.

Among the civic minded clubs of the Guild, the Orchard Park Home-Work Club, *West Lynn, Mass.*, is one of the most active. During the past year the placement bureau found work for several hundred persons, 277 toys were repaired and given to poor children, 110 clothing articles repaired, and many dinners given to poor families.

The Timbercraft Homeworkshop Club entered the *New Bedford (Mass.)* Hobby Show and won sixteen prizes. Charles Jeglinski received a trophy awarded for the best project.

Left, H. D. Herder gives a metal-spinning demonstration. More than 125 men and women attended the meeting. Below, carving in the school's manual training shop



EASY HOME TESTS



A whirling charged disk deflects a compass needle

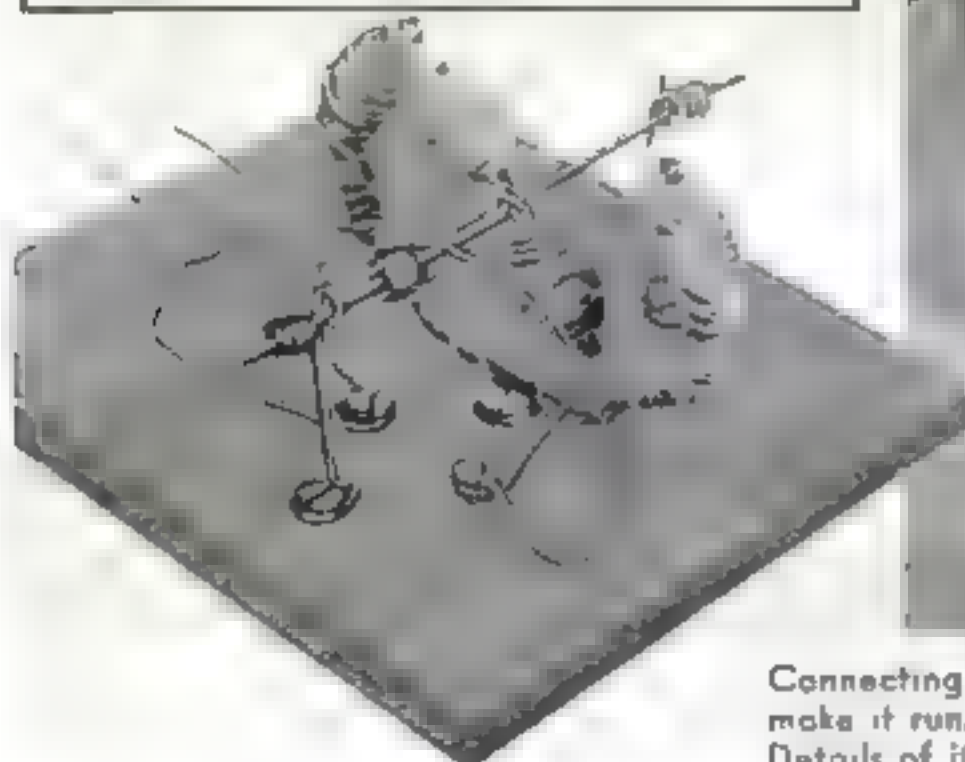
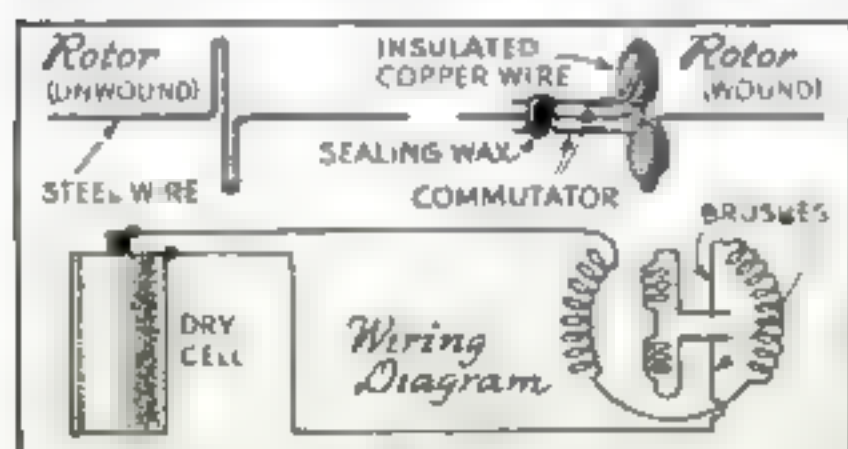
Static on Moving Object Forms Magnetic Field

TO THE shaft of an electric motor, attach a disk of hard rubber, or an old phonograph record. Electrify the disk by rubbing it with a woolen cloth. Now start the motor. Place a small magnetic compass near the edge of the whirling disk, and the needle will be deflected, showing that it has been brought into a magnetic field. Such a field is set up not only by electric current passing through a wire, a familiar phenomenon, but also by charges of static electricity on a moving object. The faster the disk spins, the greater will be the magnetic effect. This curious phenomenon was first noted by Prof. Henry A. Rowland, noted American physicist.

Miniature Motor Made of Paper Clips

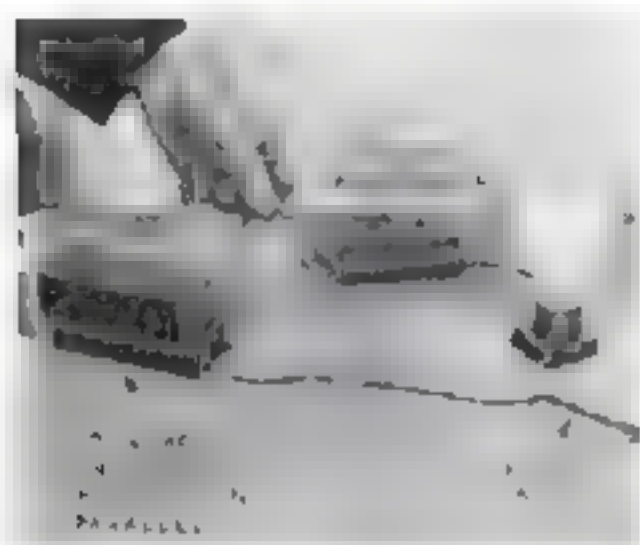
IN A few minutes' time, from several paper clips and some fine insulated wire, you can make a little electric motor that will illustrate the principle of the big fellows. The outer field magnets are wound with about twelve feet of wire, and the same

length is used to wind the two legs of the armature or rotor, as shown in the photos and diagram below. Sealing wax holds the two ends of the rotor winding to the shaft, forming a commutator. One or two dry cells will supply sufficient current to run the miniature motor, which spins merrily as long as power is supplied to it.



Connecting the paper-clip motor to a pair of dry cells to make it run. Left, a close-up view of the tiny power plant. Details of its construction are given in the diagram above

OF NATURE'S LAWS



Test Illustrates Radio Tuning

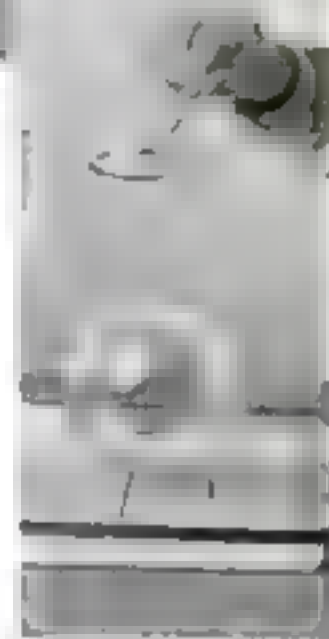
PLACE an inductance of one henry (about 1,000 turns of wire) in an alternating-current lamp circuit. The lamp dims. In series with the inductance, add condensers of three to four microfarads. The lamp brightens, because the circuit is "tuned" to pass the sixty-cycle house current freely. Next, connect the condensers in parallel. The lamp goes out. The hook-ups illustrate radio tuning and the use of "wave traps" to remove unwanted signals.

Bubble Shows How Water Drops Form



Drawn out into a cylinder, a bubble divides as at right. In high-speed photos, water droplets are seen to do the same

BETWEEN two well-soaped wire rings, draw out a large soap bubble into a cylinder. It will divide as at right, with a small bubble at the top, a large one at the bottom, and a tiny one floating between them. High-speed photographs have shown that droplets of falling water divide in the same way.



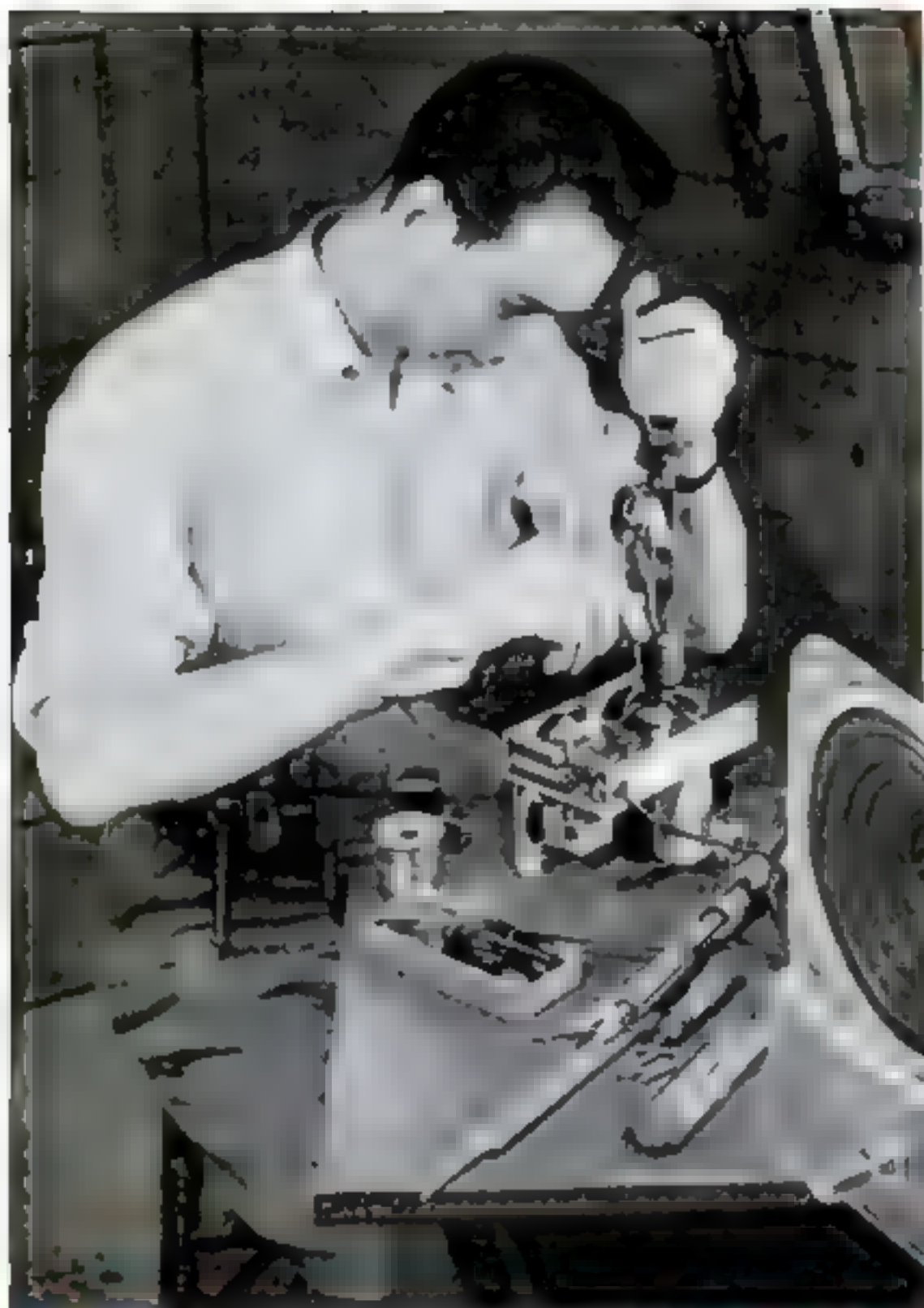
Novel Dry-Ice Gun Extinguishes Candle

TO WITHIN $\frac{1}{4}$ " of the edge, cut out the top of a cardboard salt box, and tie a piece of rubber balloon over it. Cut a $1\frac{1}{2}$ " hole in the opposite end, roughening its rim with a penknife. Load the gun with carbon dioxide

gas by inserting "dry ice." Aim the gun, tap the rubber, and an invisible ring of gas will smother a candle flame six to eight feet away. You can stage an amazing "William Tell" stunt with the gun as shown below.



For a William Tell stunt, use the gun to put out a candle mounted on cardboard and set on a friend's head

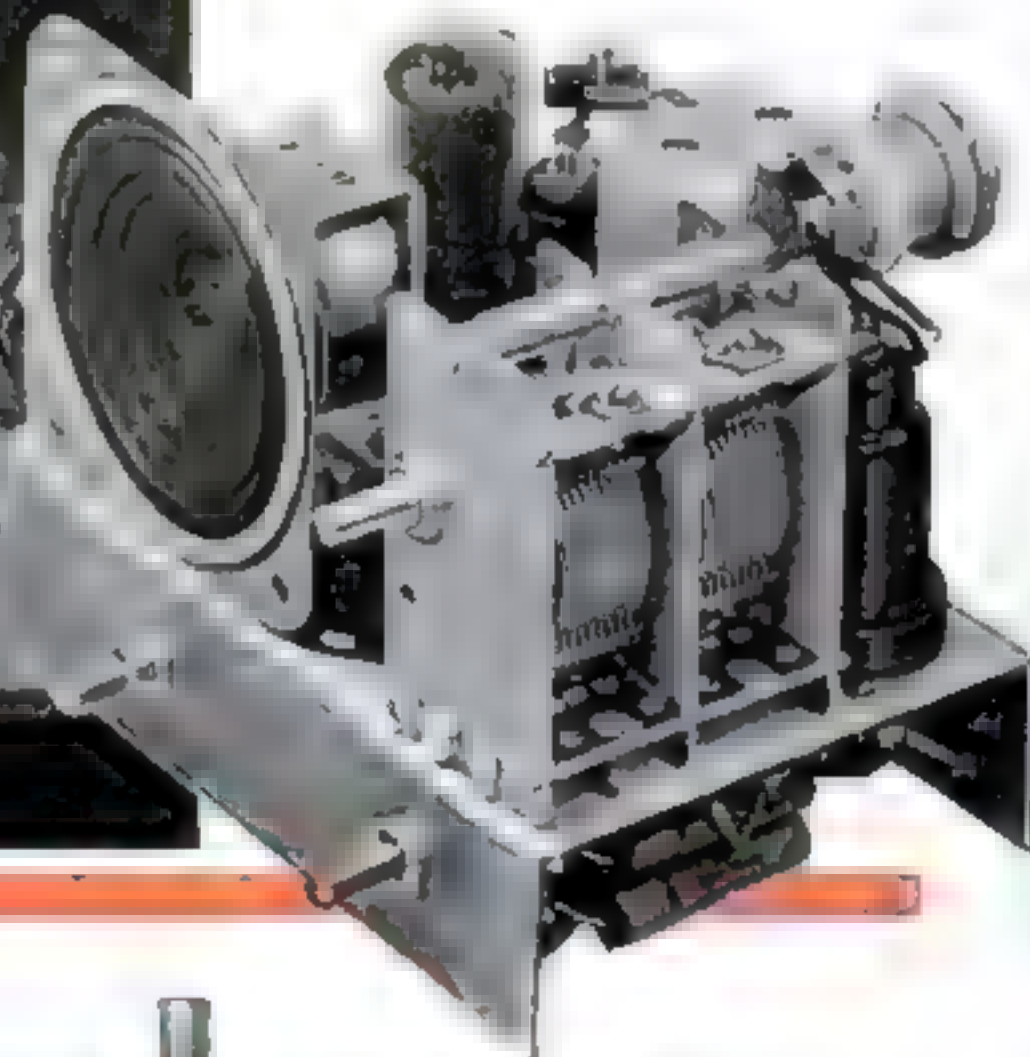


THREE-

IS IDEAL SET FOR
BEGINNERS

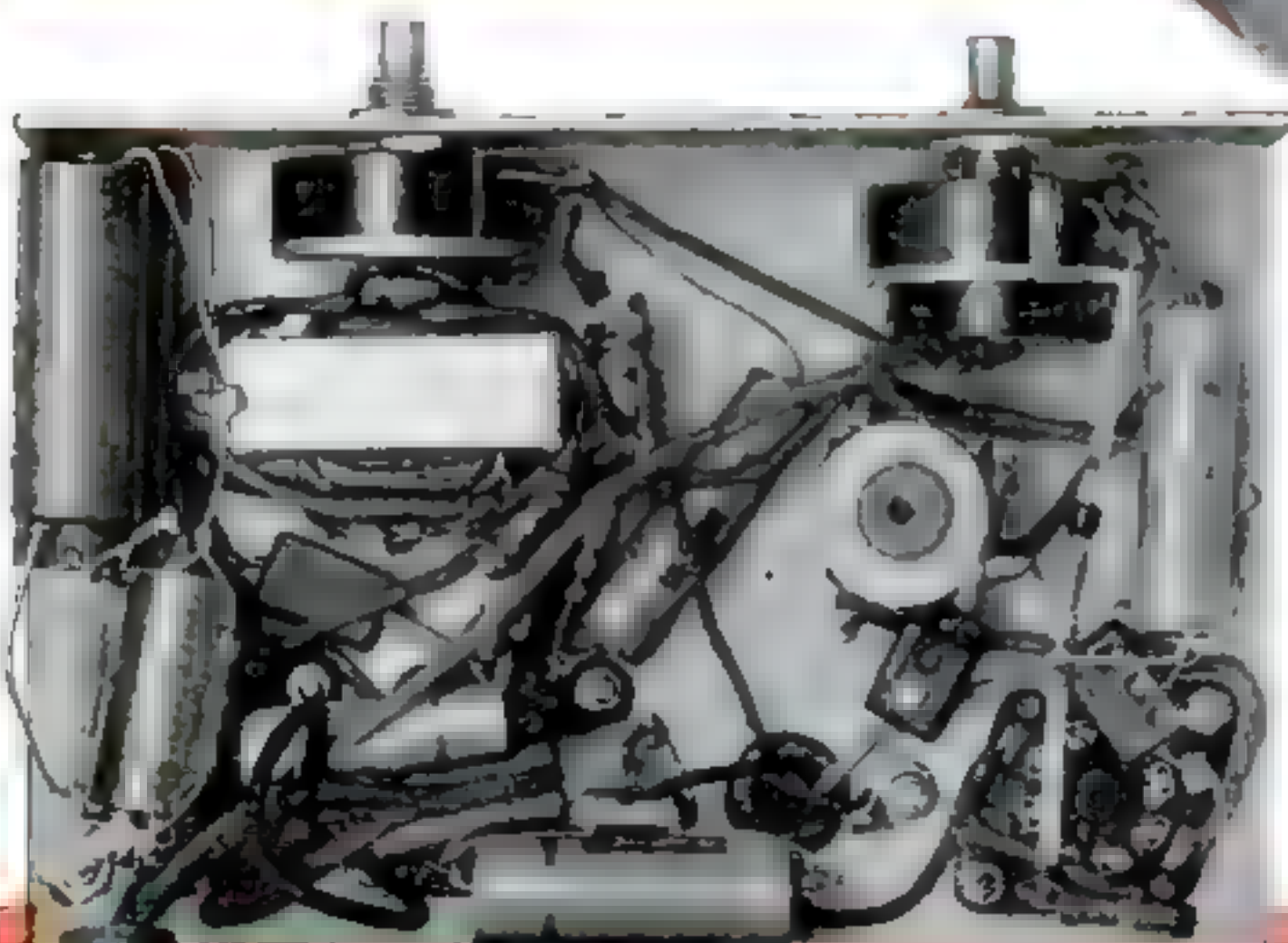
By

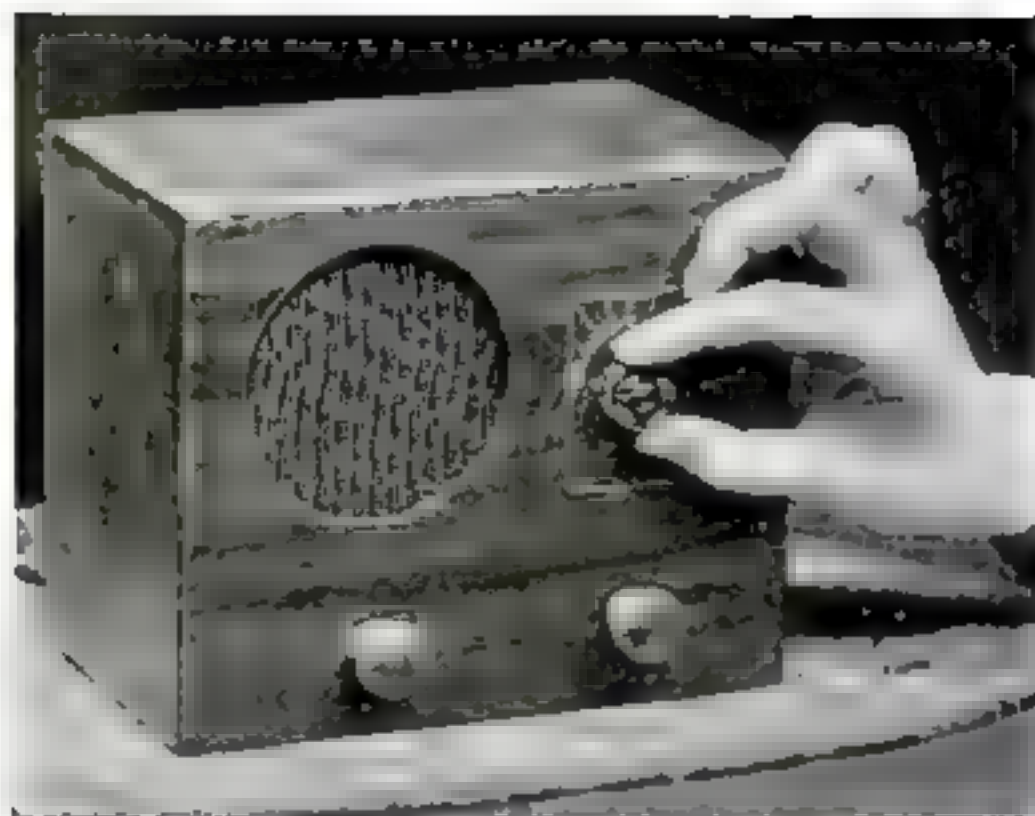
Arthur C. Miller



Top view of the chassis, above, will help you arrange the various parts. The chassis measures only 6 1/2" long by 4 1/4" in depth

Keep all connections as short as possible. The universal output transformer is mounted directly beneath the speaker shown above and secured by the same two bolts





The author built the cabinet of $\frac{3}{4}$ " thick white wood

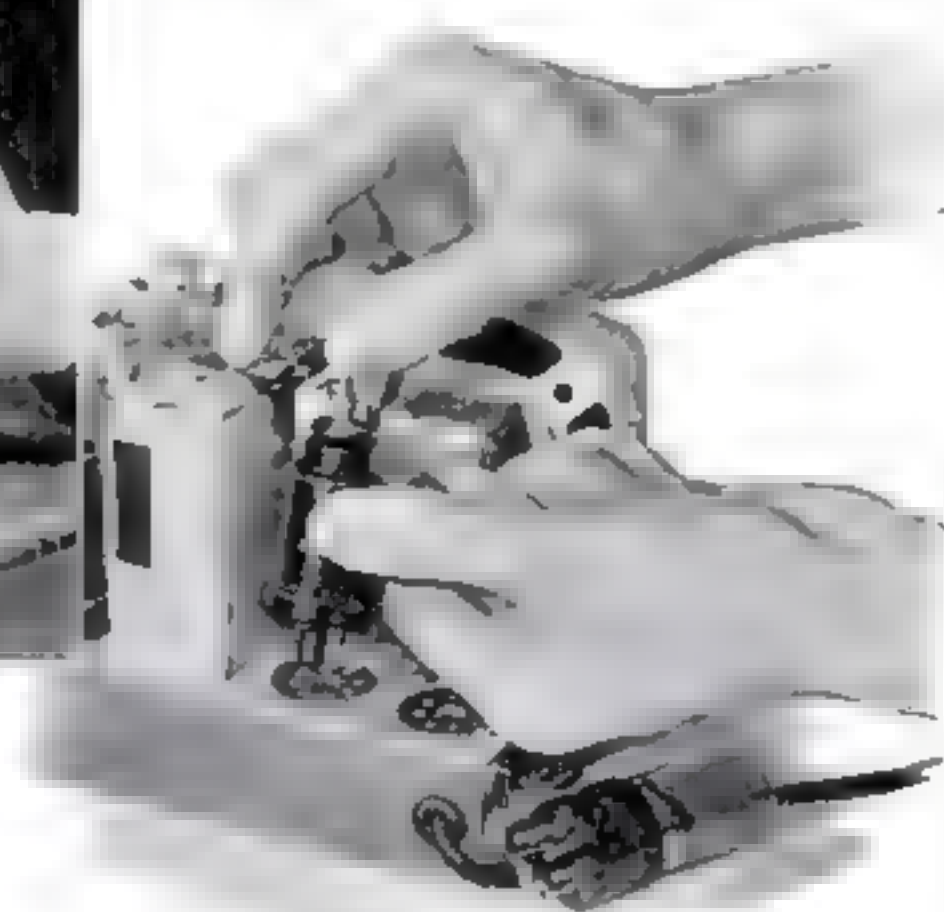
any winding so that a regenerative detector stage can be used. This stage adds greatly to the receiver's volume.

A cathode feed-back circuit is used to obtain regeneration. It consists of a .005-mfd. mica condenser and a 2,500-ohm variable resistor. If the reader lives near a powerful local station, he should add a volume control consisting of a 10,000-ohm variable resistor in series with the 300-ohm cathode resistor of the first tube.

For tuning, a standard two-gang .000365-mfd. variable condenser is used. This controls the first detector and oscillator stages whose functions are performed by the first tube, 6A8. The .0004-mfd. padding condenser in the oscillator circuit must be within three percent of the rated capacity, to avoid trouble in ganging the two condensers.

The sensitivity of this receiver, especially on distant stations, is greatly increased by the use of the 1-meg. grid leak and the .0002-

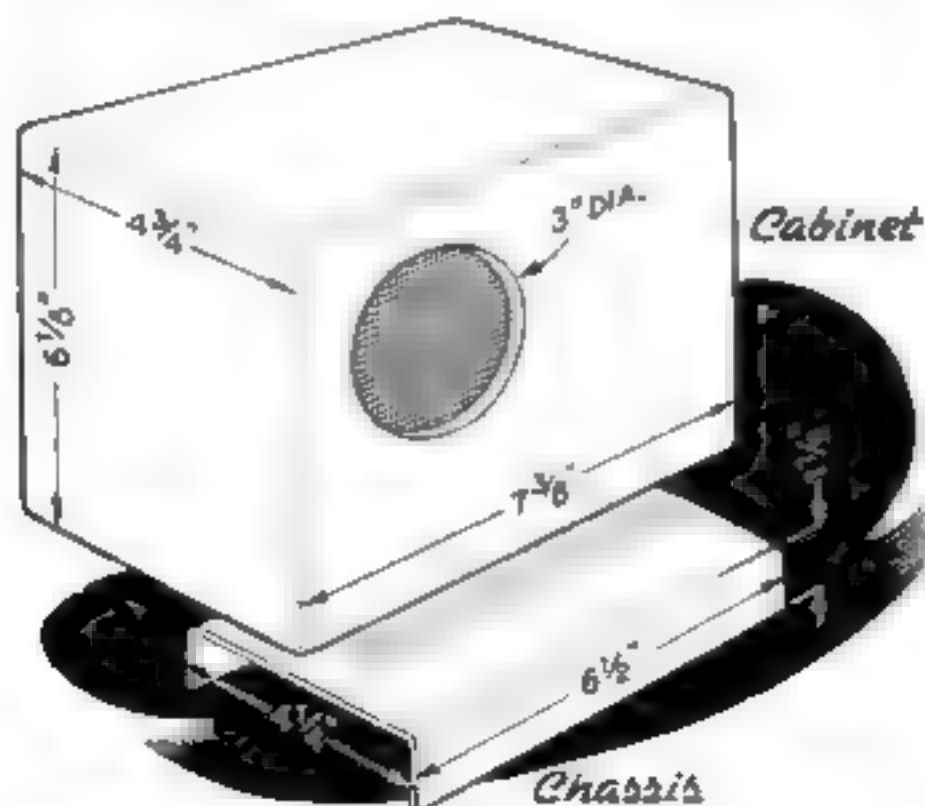
Inserting the grid leak and condenser in the grid lead of the second detector tube to step up sensitivity



mfd. mica condenser in the grid lead of the second detector tube (6K7).

The small 3" permanent-magnet speaker is connected to the output of the 32L7GT. It is mounted directly to the chassis by means of two long machine screws and metal spacers $\frac{3}{4}$ " long. The universal output transformer is mounted directly beneath it under the chassis, held by the same two screws.

Here are overall dimensions of chassis and cabinet



LIST OF PARTS

3" Permanent-magnet speaker.
Universal output transformer.
Regenerative I.F. transformer with tap, 455 kc.
Line-cord resistor, 250 ohm.
Antenna coil.
Oscillator coil, 455 kc.
Tubes, 6A8, 6K7, and 32L7GT.
Regeneration control, 2,500 ohm.
Electrolytic condenser, 20 mfd., 150 volt.
Electrolytic condenser, 40 mfd., 150 volt.
Electrolytic condenser, 10 mfd., 25 volt.
Two-gang tuning condenser, .000365 mfd.
Mica condenser, .005 mfd.
Mica condenser, .0001 mfd.
Mica condensers (2), .002 mfd.
Tubular condensers (2), .05 mfd., 400 volt.
Tubular condensers (2), .02 mfd., 400 volt.
Tubular condenser, .1 mfd., 400 volt.
Carbon resistor, 250 ohm, 1 watt.
Carbon resistors (2), 300 ohm, $\frac{1}{2}$ watt.
Carbon resistor, 300 ohm, 2 watt.
Carbon resistors (2), 50,000 ohm, $\frac{1}{2}$ watt.
Carbon resistor, $\frac{1}{2}$ meg., $\frac{1}{2}$ watt.
Carbon resistor, $\frac{1}{2}$ to 1 meg., $\frac{1}{2}$ watt.
Carbon resistor, 150,000 ohm, $\frac{1}{2}$ watt.
Carbon resistor, 2 meg., $\frac{1}{2}$ watt.

Miscellaneous: Volume control (optional); S.P.S.T. switch plate; three octal wafer sockets; chassis; cabinet, wire, etc.

ELECTRIC 'B' SUPPLY FOR PORTABLE SETS

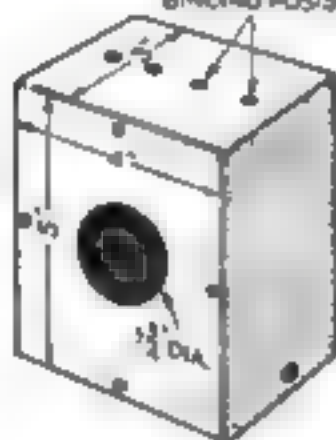


Scarcely a handful, it fits inside most portable radios

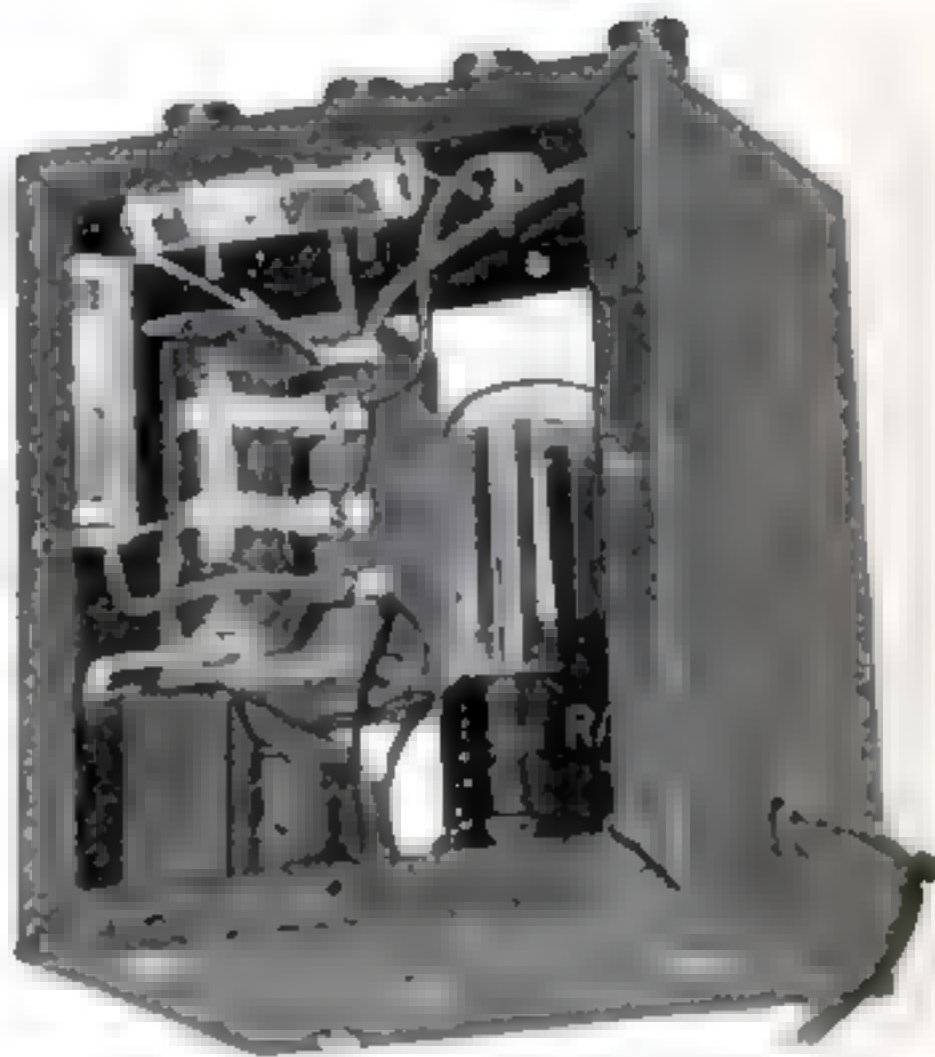
THIS compact "B" power pack, no larger than a standard-size portable "B" battery is a highly useful radio accessory. It is small enough to fit in many of the modern battery portables and may be used to replace "B" batteries in small table receivers of either the tuned radio frequency or regenerative types, for hum-free reception.

An adjustable bleeder circuit is wired across the output of the rectifier, and the connections are brought out to four insulated binding posts on top of the cabinet. The bleeder circuit consists of a 10,000-ohm semi-variable wire-wound resistor with two sliders for adjusting the intermediate voltages.

Steel Cabinet
HOLES FOR BINDING POSTS

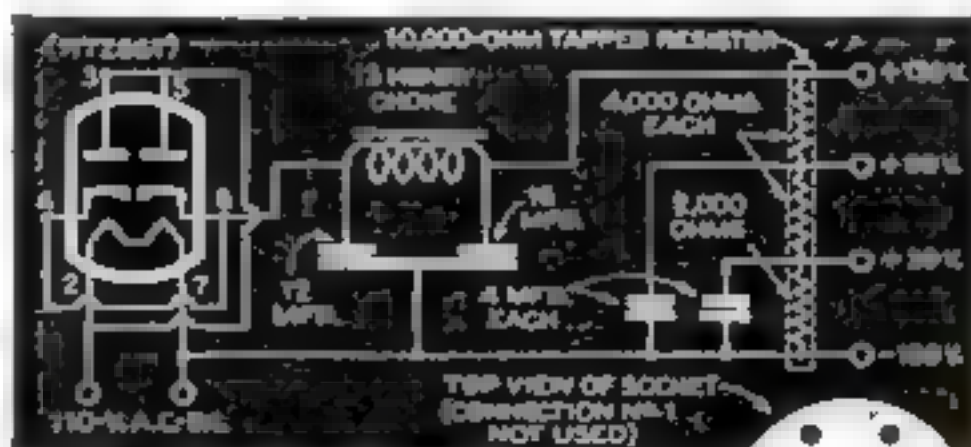


This photograph will help you assemble the outfit in its steel cabinet



As shown in the diagram, the circuit is adjusted to give 130, 90, and 30 volts at the different taps when connected to a set drawing about 15 milliamperes plate current.

The 117Z6GT rectifier tube is connected directly across a 117-volt power line without the use of resistors. A 1 1/4" ventilating hole should be drilled in one side of the cabinet.



Parts needed for the unit can be itemized from the diagram. Note that the circuit is not grounded



NEW WRINKLES

Decorative Globe Tunes Novel Table Radio



Speaker and antenna are in the globe; controls are on the base

You tune in radio stations by revolving the decorative and useful terrestrial globe that tops a sensitive new receiver. Both its loop antenna and speaker are housed within the globe. The volume control and switch are on the polished walnut base that houses the set's A.C.-D.C. superheterodyne circuit. Continents, oceans, national boundaries, and other geographical details make the globe a handy atlas. An amber light shows when the set is on.

Converter Supplies Six-Volt Sources

OPERATING any six-volt, single-battery radio from a 110-volt, A.C. outlet, a compact converter just introduced provides two separate sources of six-volt current. Inasmuch as two-volt tubes wired in series are used in some sets, while six-volt tubes, or combinations of six and two-volt tubes are used in others, the outfit was designed to fit the needs of them all. The two current sources also permit separation of the vibrator and filament circuits, thereby eliminating hum and other disturbances.



The unit can be used on any single-battery, six-volt set

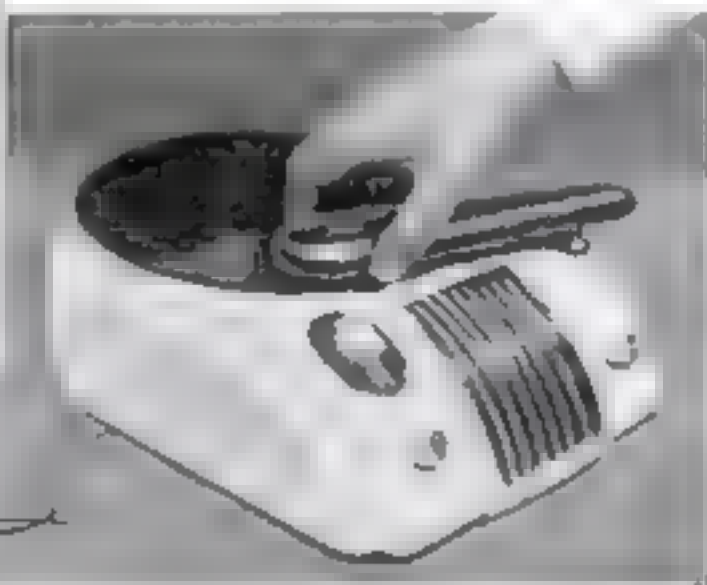
Suitcase Radio Phonograph

ONE of the smallest radio phonograph combinations yet offered packs within its all-metal cabinet a four-tube receiver and a powerful, self-starting electric motor to drive its turntable. Good volume and clarity of tone are claimed for the combination, which is available in a brown or an ivory finish. The same

volume control is used for both the tuned-radio-frequency receiver and the phonograph which takes records up to twelve inches in diameter—the exact length of the cabinet. It stands but four inches high, and is ten inches wide. The convenient carrying case illustrated is available with the outfit.



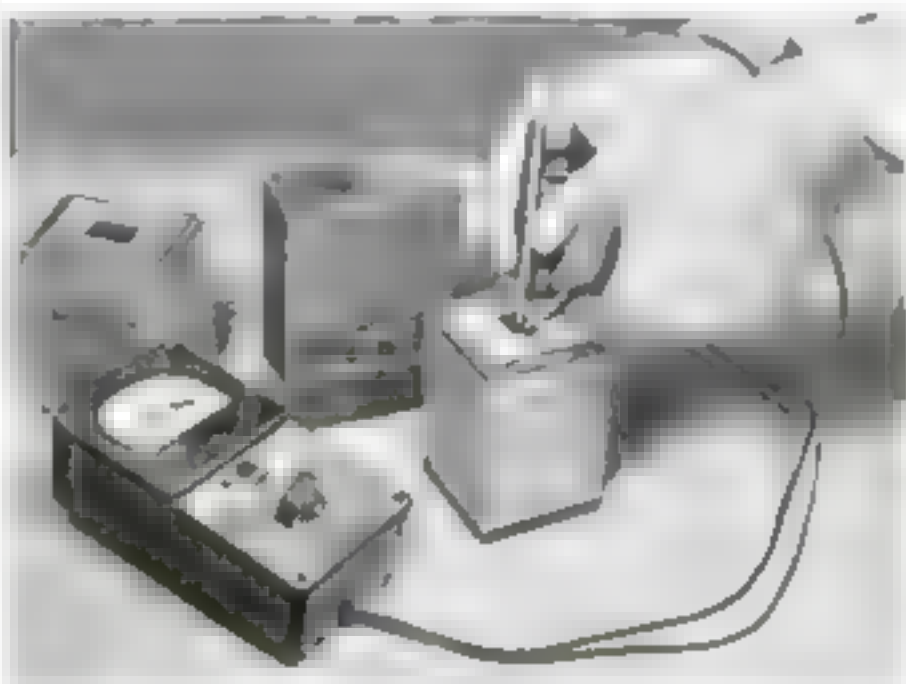
Tiny combination radio-phonograph and its handy case



for RADIO AMATEURS

Compact Battery Tester Fits in Your Pocket

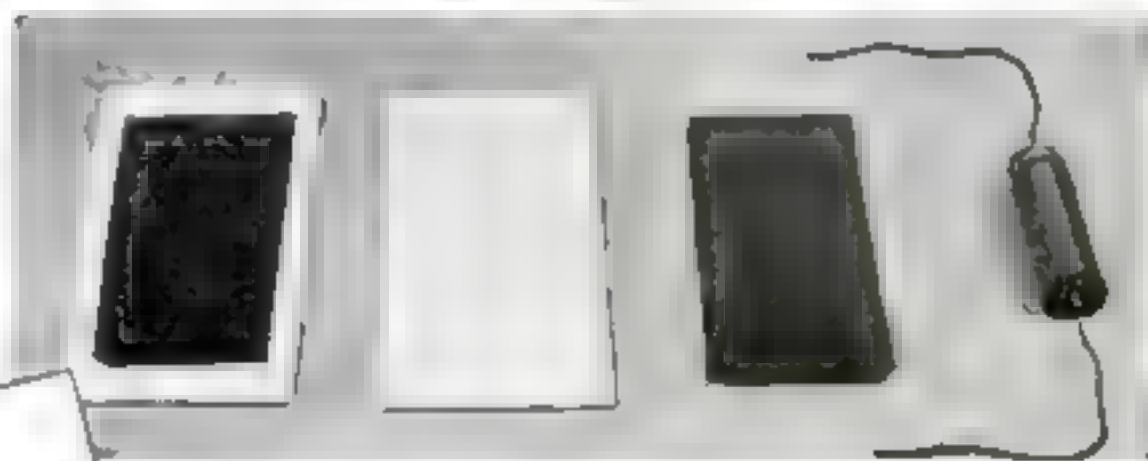
AMATEURS as well as service men will find the new pocket-size, dry-battery tester shown in use below a handy accessory. A switch on the instrument makes it possible to adjust the unit for testing batteries of various voltages. In addition, it may be adjusted to test batteries under load. Having an easily read, calibrated dial, the tester is housed in a black composition case.



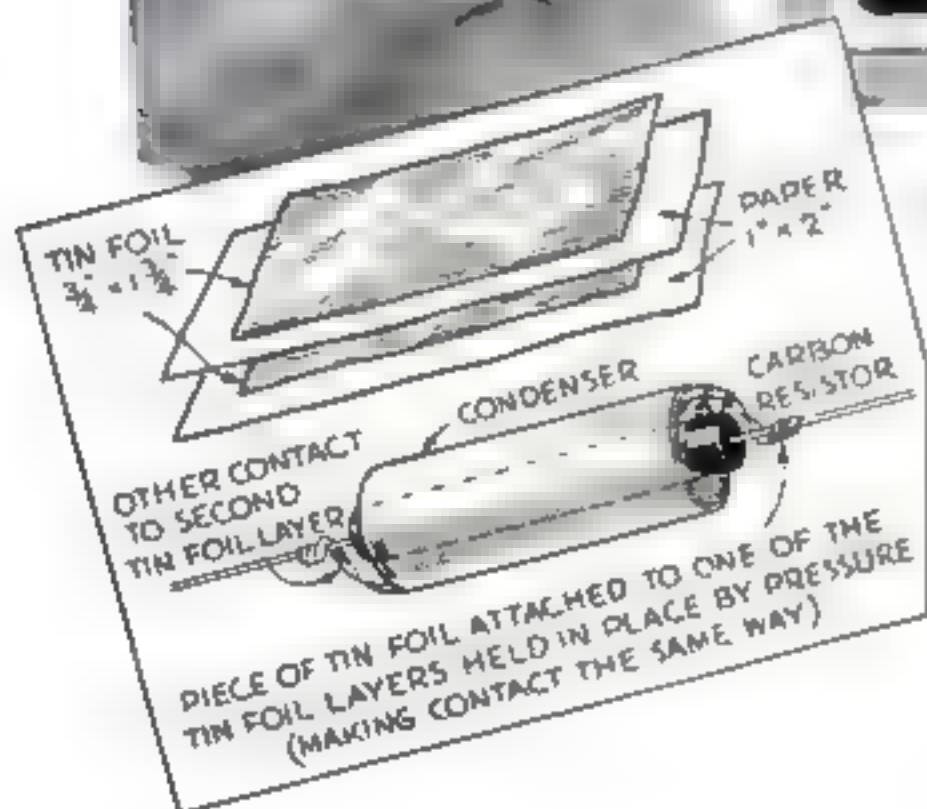
A dial pointer shows the condition of the battery

Electric Unit Heats New Pencil Soldering Iron

SOLDERING those hard-to-get-at places is greatly simplified with the new pencil iron illustrated above. Mounted by means of a set screw in a bracket that may be fastened to a workbench, the electric heating unit has a hollow end in which the tip of the iron is inserted, then withdrawn for use. Because of its size, the heating unit is very durable.



Tin foil for the condenser may be stripped from cigarette pack. The paper is plain pad paper



YOU can make your own grid-leak-condenser unit out of tin foil, pad paper, and a one-watt, two-megohm carbon resistor. Cut two strips of tin foil an inch and three quarters long and three quarters wide, and two insulating paper strips one by two inches. Sandwich the strips as shown, wrap them around the resistor, fasten them with mending tape, and connect each piece of the foil to one of the resistor leads.

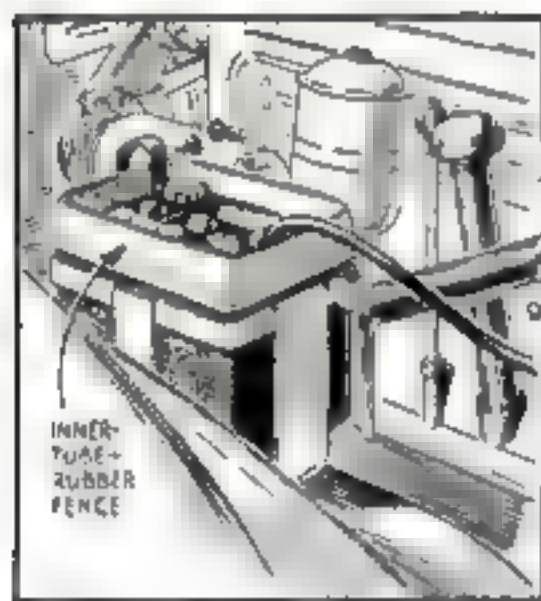
Tricks for Motorists



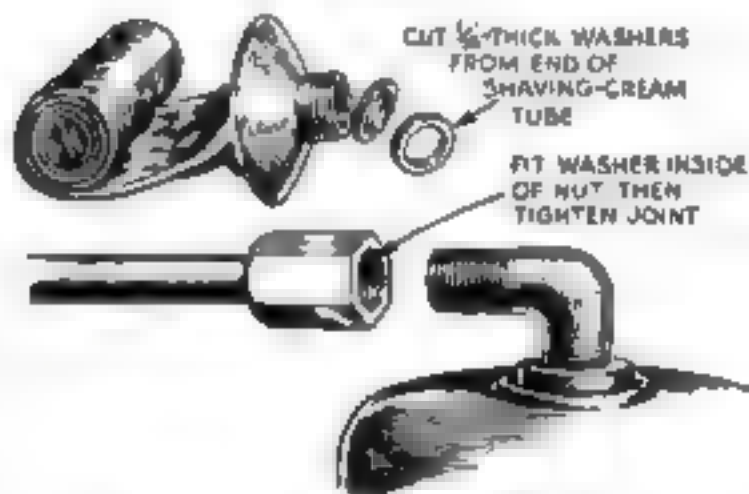
Extension for Electric Drill Helps in Close Work

A LONG extension for an electric drill is often handy when installing radios or heaters, or doing other work around an automobile. The extension I use was made from a half-inch, cold-rolled steel rod about thirty-six inches long. One end fits into the regular drill chuck, while the other is threaded to take a second chuck that can be purchased at little expense at almost any hardware store. By using this extension, I can drill in confined quarters with little danger of damaging wiring or other delicate parts.—W. A. S.

Rubber Fence on Battery Top Keeps Acid from Spreading



ON LATE-MODEL automobiles that have their batteries underneath the hood, any possible damage to wiring and metal parts can be prevented by stretching a section of inner tube two inches wide around the top edge of the battery. This keeps acid from spreading if the battery is overfilled.—E. J. C.

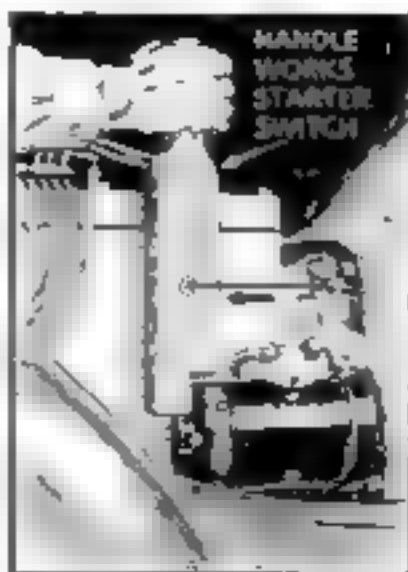


Shaving-Cream Tube Yields Pipe Washer

I FIXED a leak at a fuel-line connection in my car by fitting inside of the nut a 1/16" washer cut from the tip of a shaving-cream tube. Because this washer is soft, it spreads when the nut is tightened and forms a good seat. The washer can be cut and trimmed to fit with an ordinary knife. The same stunt can also be used to advantage in oil-line connections and other places where a leakproof pipe joint is needed.—R. B.

Starter Handle Is Used in Motor-Testing Jobs

TO START a car when testing or adjusting the engine, the wooden handle shown at the right is convenient. Resting on the starter motor, the handle carries a wire rod that hooks around the starter-pedal arm. By pulling back the handle, which can be reached from either side of the engine, the starter is made to operate.—F. G.



YES, IT'S A REFLEX



AND ONLY \$5²⁵

SEE THOSE TWO LENSES? The new Brownie Reflex is a "twin-lens" reflex... one lens for viewing, the other for taking.

And that makes it a better reflex in two ways... (1) you see the image (full negative size, right-side-up) even while the exposure is being made... and (2) the image is always fully lighted, and brilliantly clear.

But that's just the beginning. Check all the features (see panel at right), and you will agree that this new Brownie is a true Brownie in the simplicity, certainty and economy which it brings to "reflex photography." At your dealer's.

EASTMAN KODAK COMPANY, ROCHESTER, N. Y.

You see the picture—full negative size and brilliantly clear—while you're making it • Finder has folding hood • Fixed focus • Snapshot and "bulb" exposures • Push-button shutter release • Uses inexpensive 127 Kodak Film • Makes 12 pictures, $1\frac{1}{2} \times 1\frac{1}{2}$ inches (recommended standard enlarged print size, $2\frac{1}{4} \times 2\frac{1}{4}$ inches).

GOING TO THE NEW YORK FAIR? Take your Kodak—visit the Kodak Building—see the Greatest Photographic Show on Earth.

New BROWNIE REFLEX

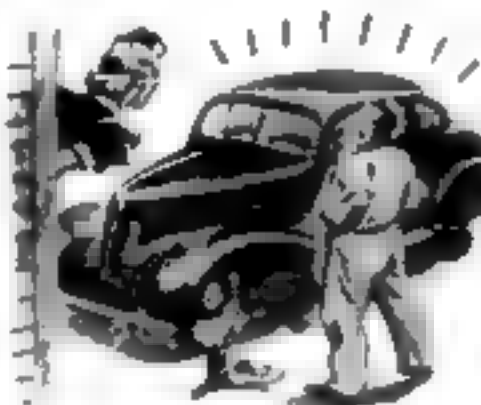
"I certainly am *NOT* loafing"

ME LOAFING? I should say not! When Susan called, I was merely deep in thought. "I know I am supposed to polish the car," I said. "But, Susan, you do not understand. I have been lying here inventing a new and easier method for polishing autos."



"WELL, you can stop inventing right now," said Susan, pointing to the No. 7 Polish ad in my magazine. "Somebody beat you to it. And if this polish is as easy to use as everybody says it is, even you can shine the car quickly. Now get goin'!"

SOON AFTER, Susan stuck her head out the window and shouted: "Stop gawking at the neighbors' new car and get that polish!" "But, Susan," I replied, "this is our car. It was so easy polishing it with No. 7 I think I'll go into the car-polishing business!"



DU PONT No. 7 POLISH

made by the makers
of DUCO* and DULUX*

* Reg. U. S. Pat. Off.

WANT A SAMPLE?

DU PONT CO., Dept. 4-SP, Wilmington, Del.

Please send me a sample of the improved No. 7 Polish—enough for hood and fenders. I enclose 6¢ to help cover mailing costs.

Name _____

Address _____

City & State _____

Offer good in U. S. only

WINDSHIELD AND TOP MOULDING LEAKS stopped quickly and securely with **DU PONT TOP SEALER**. Good for rear window leaks, too.

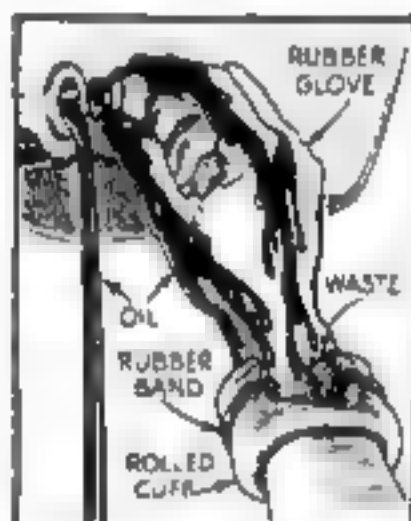


Sandbags Form a Ramp For Lifting End of Car

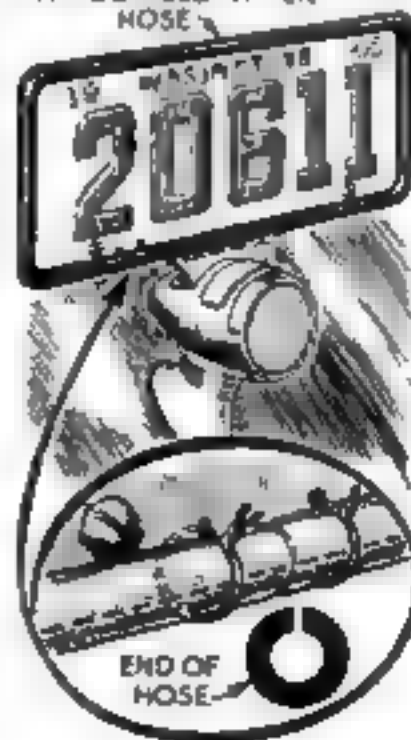
WHEN I want to do repair work under the front end on my car, I get extra working space by running the front wheels up on sacks filled with sand. I find that this method is easier, quicker, and safer than raising the car on jacks. Chocks placed under the rear wheels, as illustrated, keep the car from rolling off the improvised ramp.—R. A.

Gloves Keep Oil off Arms

TO PROTECT my hands and arms when working around the car, especially when draining the oil, I wear a pair of long rubber gloves, with the cuffs turned up and stuffed with old rags or cotton waste. A rubber band holds the cuffs in place, so that oil does not run off the gloves onto my arms but is absorbed by the material in the cuffs, which can be thrown away.—W. L. G.



WINDSHIELD-WIPER
HOSE



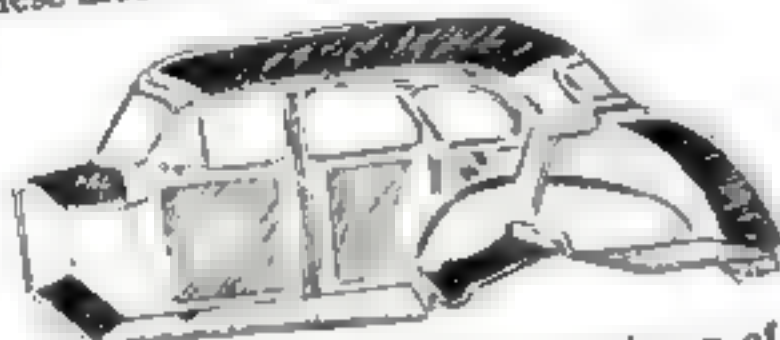
Rattleproof Plate Frame

A RATTLEPROOF and rustproof license-plate frame can be made from windshield-wiper hose. Split the hose with a vise-held jack-knife, and stretch it around the plate rim, fastening the ends with fine wire, as illustrated in the drawings reproduced at the left.—L. J. Van D.

ADVANCED COMFORT

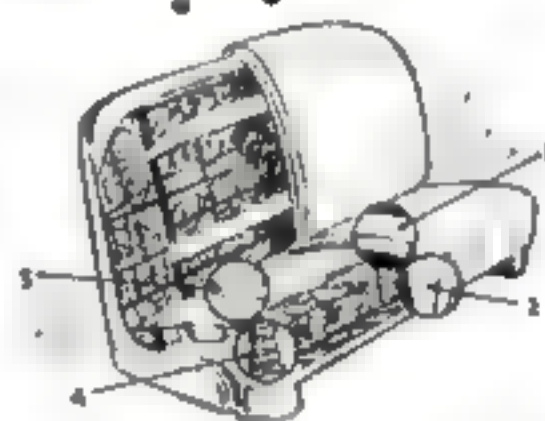
*in the longest, widest, strongest Unisteel Turret Top
BODY BY FISHER ever built*

Although increased roominess is one major source of advanced comfort in the new Body by Fisher, an analysis of its construction reveals still others. Seat construction, insulation and the type of glass used are important factors, too. Here are examples of these modern features as they apply to the new Body by Fisher on the 1940 Chevrolet.



Pad-Type Insulation—Not Sprayed—Insulation of a car body serves a threefold purpose: to prevent radiation of engine heat and high climatic temperatures; to keep out cold; to deaden engine, road and traffic noises. Spraying insulation material on the panels is an inexpensive, old-type method some cars still employ. Body by Fisher, however, uses a more efficient method: the application of pad-type insulation, which insures adequate coverage at all points—even in the lowest-priced models. Chevrolet, for instance, is the only car in its price class with a rock wool padded cowl.

Reducing Eyestrain—There is no Safety Sheet (or laminated "window") Glass in the new Body by Fisher. All glass areas—not only the windshield—contain genuine, Safety Plate Glass. With Safety Plate Glass there is considerably less distortion than with ordinary Safety Sheet Glass. Tests show, in fact, that Safety Sheet Glass produces 62% more eyestrain than Safety Plate Glass.



Constructed Like Fine Furniture—Beneath the finest upholstery—cut to precise size and hand-fitted—you find all of the following features in the seats of the new Unisteel Turret Top Body by Fisher. First, a deep cotton blanket (1) atop an abundant layer of special padding (2). Then a burlap sheet (3) to keep the springs permanently in place. And the springs themselves (4) are specially designed for lasting resilience and to prevent sagging.

"IT'S FIRST AGAIN" is what value-minded motorists are saying of the 1940 Chevrolet. And a major "first" most certainly is its new Body by Fisher—in beauty, comfort and safety. For instance, it provides the new Chevrolet Special De Luxe Sport Sedan shown here with stronger, safer 1½ Test Safety Plate Glass throughout all door windows and Ventapanes as well as the windshield.



Fisher

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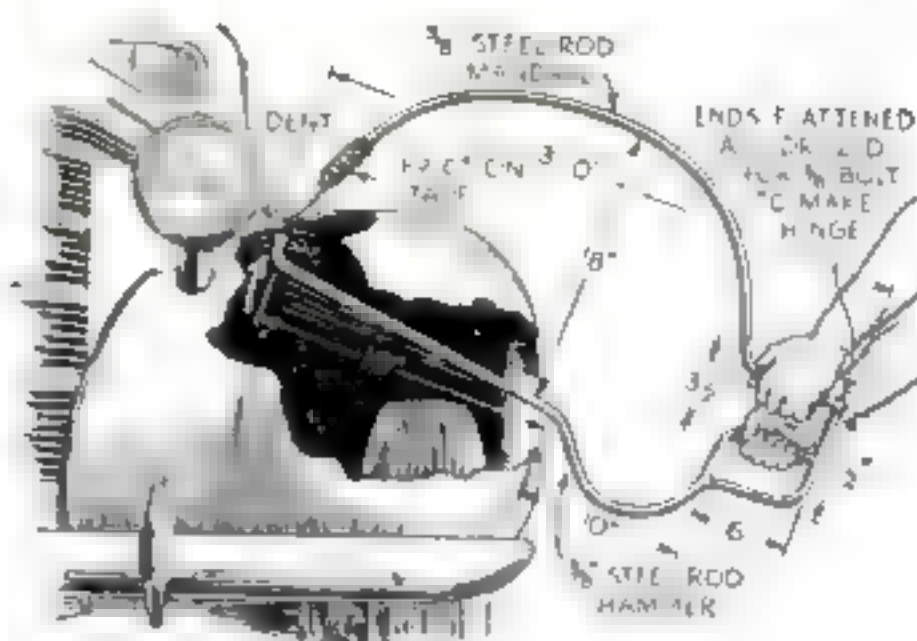
15¢



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BOND STREET
Pipe Tobacco

A Product of PHILIP MORRIS

Fender Tool Combines Hammer and Mandrel



WITH the pecking hammer generally used to smooth out small dents in a damaged car fender, a repairman must hit the low spots solely by his sense of touch, making the process slow, tedious, and unsatisfactory. To make this job easier, I devised a tool made of $\frac{3}{8}$ " steel rods, with one end of each flattened and drilled so that the two may be bolted together to make a hinge on which the lower piece can swing. The open end of the upper section, or mandrel, is ground to a flat curve and receives the point of the lower or hammer section, which is ground into a ball shape. Both rods are bent to clear the fender edges. In use, the tip of the mandrel is held at the edge of a dent, and the hammer brought up sharply against the underside by using the built-in hand holds indicated in the sketch. I have used the tool in a wide variety of fender repairs, and it always did a first-class job.—C. N.

Vacuum Cup Holds Light

A RUBBER vacuum cup attached to the hanger ring of the flash light you keep in your car will increase the light's usefulness.



When changing a tire at night, for example, you can throw the light right onto the work by attaching the vacuum cup to the fender above the wheel. In the same way, it may be fastened to illuminate the motor or the trunk compartment, or any other spot where light is needed.—E. F.

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| Thread | 3/8"-24 | 1/4"-32 | 1/4"-32 |
| Thread Length | 7/32" | 7/32" | 7/32" |
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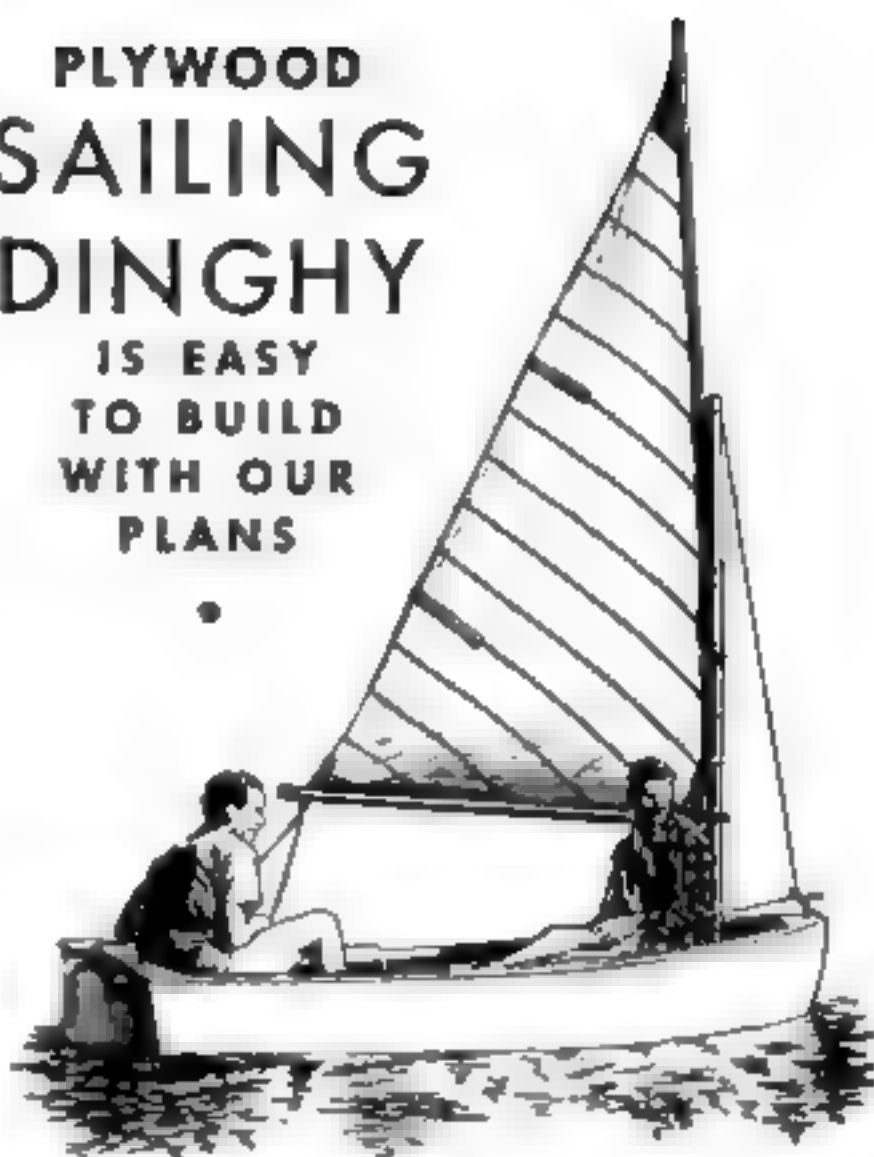
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THE use of plywood makes our new sailing dinghy the simplest boat to build for which we have ever offered plans. Weighing between 60 and 75 lb., the boat is easily transported and is therefore ideal for fishing and hunting trips, or at camp. It may also be used as a general-utility boat around a bathing beach or summer cottage. It is 9' 7" long, and the hull costs approximately \$20 for materials. A set of blueprints (Nos. 387-388) can be obtained for only 50 cents; full-size patterns of the stem, frames, transom, and rudder are \$1.50 additional. If you wish both blueprints and patterns, send \$2.00.

Plans for other types of boats as well as various woodworking projects are also available. A few are listed below; a complete list will be sent upon receipt of a self-addressed, stamped envelope.

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| Cabin Cruiser, 17' long, weighs 750 lb., for use with outboard or inboard drive, 356-357-358-359-R | \$1.50 |
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| Fisherman's Outboard Boat, 9' 3" or 11' 6" long, weighs 115 or 160 lb., for motors from 3 to 16 h.p., can also be rowed, 344-345-R | .75 |
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| Inboard Boat, 15' long, weighs 325 lb., for motors from 1/2 to 5 h.p.; can also be rowed, 384-385 | .50 |
| Midget Boat or Pram, 9' long, for oars, sail or outboard motor, 339-R | .50 |
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| Plywood Dinghy, 9' 7" long, weighs 60 to 75 lb., can be rowed, sailed or used with small outboard motor, 367-368 | .50 |
| Racing Sailboat BLACKCAT, 13' 4" long, weighs 250 lb., Marconi rigged, 321-322-323-R | 1.00 |

(Continued on page 206)



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(Continued from page 204)

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| Sectional Rowboat, 9' 8" long; can be used with small outboard, 340-341-R. | .75 |
| Skiff, 13' 9" long 4' 7" beam, weighs 225 lb., for 1 to 16 h.p. outboard motors, can be rowed, 363-R. | .50 |
| Sport Runabout, 9' 8" long, for small outboard motors, weighs 100 lb., 309-310-R. | .75 |
| Utility Rowboat, 13' long; can also be sailed or driven by outboard motor, 224-R. | .50 |



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| Clipper Ship in a Bottle, 121-122 | .50 |
| Clipper Ship BOVEREIGN OF THE SEAS, 20 1/2" hull, 51-52-53-R | 1.00 |
| Cody Coach, 13" long, 144-145-146-R | 1.00 |
| CONSTITUTION ("Old Ironsides"), 21" hull, 57-58-59-R | 1.00 |
| Cruiser U S S. INDIANAPOLIS, 12" long, 216 | .25 |
| New Bedford Whaleboat, with complete equipment, 14" long, 328-R. | .50 |
| Privateer SWALLOW, a Baltimore Clipper, 13" hull, 228-229-230-R | 1.00 |
| Racing Yacht, 20" Marconi-rigged sailing model, 48-R | .50 |
| Spanish Treasure Galleon, 24" long, 46-47 | .50 |
| Trading Schooner, 17 1/4" hull, 252-253 | .50 |
| U. S. Battleship TEXAS, 3' hull, 197-198-199-200 | 1.00 |
| Viking Ship, 20 1/4" long, 81-82-R. | .75 |



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| Gate-Leg Table, 3' 6" diameter, circular top with leaves up (no turning), 34 | .25 |
| Modernistic Stand (24 1/2" high) and Bookcase (70 1/2" high), 88 | .25 |
| Sewing Cabinet of 1812, 178A | .50 |
| Tavern Table and Scroll Mirror, 105 | .25 |
| Telephone Table and Stool, 18 | .25 |
| Tilt-Top Table, 20" by 24" top, 249A | .25 |



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Use two-ply wood made by gluing two pieces of $\frac{1}{8}$ " whitewood together with casein glue in a press. The squirrels' eyes are small, black-headed pins. For the seahorses and dogs, obtain the smallest size of artificial eyes from a taxidermist or use black enamel. Drill holes as indicated for sewing on the buttons, and finish with two coats of spar varnish. No holes are drilled in the squirrel, the thread going over the leg.—E. B. Fox.

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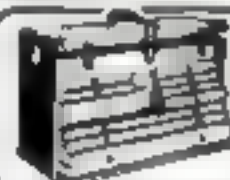
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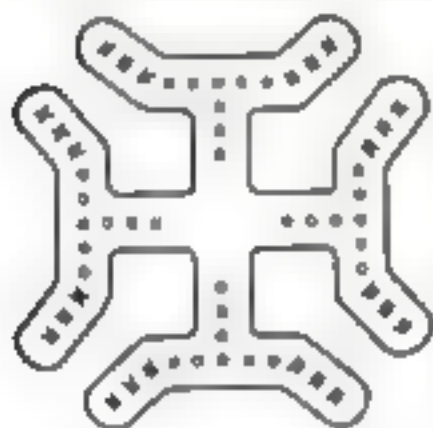


Old Gas Burner Improved by Plugging End Holes

OLD-STYLE gas stove burners of the type illustrated will heat quicker and give better control for slow cooking and simmering if their outer holes are plugged. You can try this by plugging about half the outermost holes with ordinary soap and tuning the air mixer to suit the new flame. If you are satisfied the change is advantageous, plug the holes permanently with iron cement.

In tests, an altered burner brought water to the boiling point in 35 percent less time than the old shape of flame while burning gas at the same rate and heating a similar

amount of water in a similar pan. An electric pyrometer showed a temperature of 1,100 deg. F. at a point $\frac{1}{4}$ " under the pan over the original burner, as compared to 1,450 deg. F. in the corresponding position under the pan being heated by the flame from the improved burner.—S.W.J.



A gas burner of this old type is more efficient if the outer holes are plugged up

Standard Corner Beading Useful for Many Purposes

WOODEN corner beading, which is a stock molding sold at all lumberyards, is a useful material to have on hand for building frameworks and other structures in which strength and rigidity must be combined with trim appearance. It serves the same purpose in woodwork that angle iron does in metal work. The standard corner beading is $1\frac{1}{4}$ " on each side and is $\frac{3}{8}$ " thick.

Pencil Sharpener Repoints Bone Knitting Needles

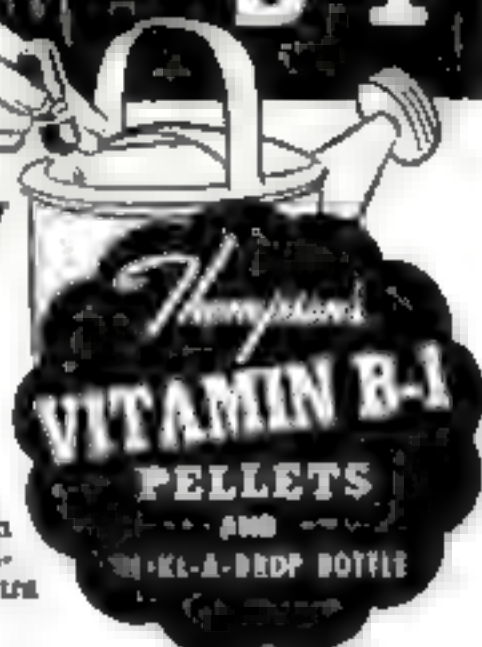
BONE knitting needles may be sharpened or repointed by using a pencil sharpener. Allow the needle to turn in the hand a little to insure an even, smooth point.—J. J. JARVIS.

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Saw-Filing

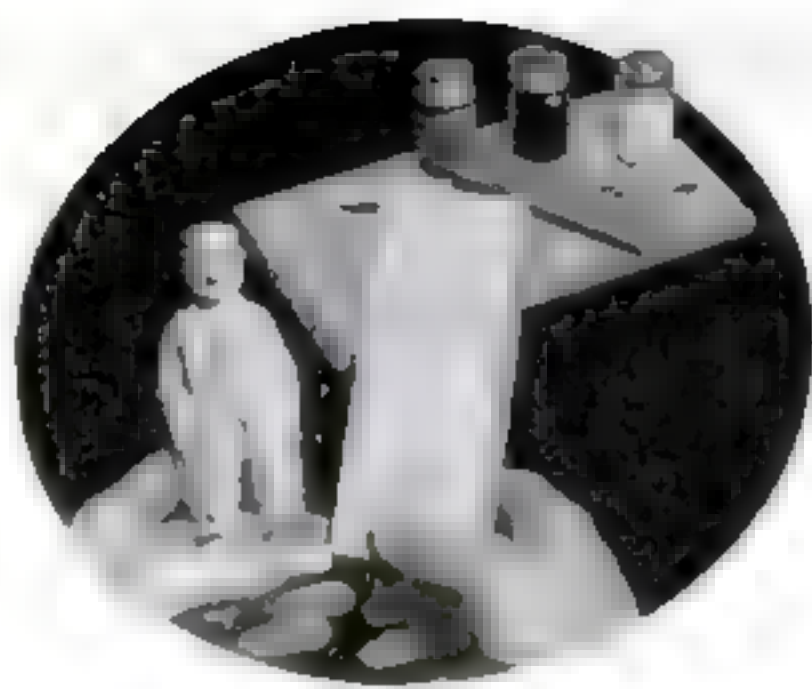
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For beginners we recommend our special copycraft whittling kit pictured above (No. 10, price \$1.50). This contains a master model of "Hobo Hank" so that all you have

to do is to copy it cut by cut on the stenciled pine block. The figure is 5 1/2" tall.

A similar kit is available for carving an elephant (No. 11, \$1.50). The package contains a composition model 3 1/2" high, whittling block, and a special V-shaped carving tool for making the grooves and wrinkles on the animal's hide.

"Skipper Samuel," a sea captain 5 1/2" tall, has been a favorite



Kit No. 7

with whittlers ever since we first issued the kit five years ago. The kit (No. 7, \$1.50) contains two shaped blocks.

Six different Scottie dogs can be carved with Kit 8 (\$1.00). Each block is approximately 1/2" by 2" by 2 1/4" and is roughly sawed to shape.

We also have construction kits for a wide variety of ship models. The complete list may be found on page 216 of last month's issue (June), or you can send a stamped, self-addressed envelope for an illustrated price list. Address Popular Science Monthly, Dept. 70A, 353 Fourth Avenue, New York.

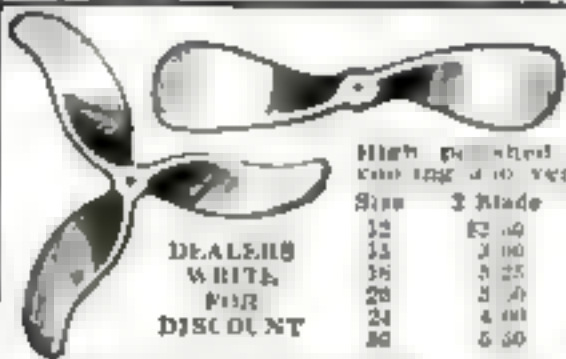


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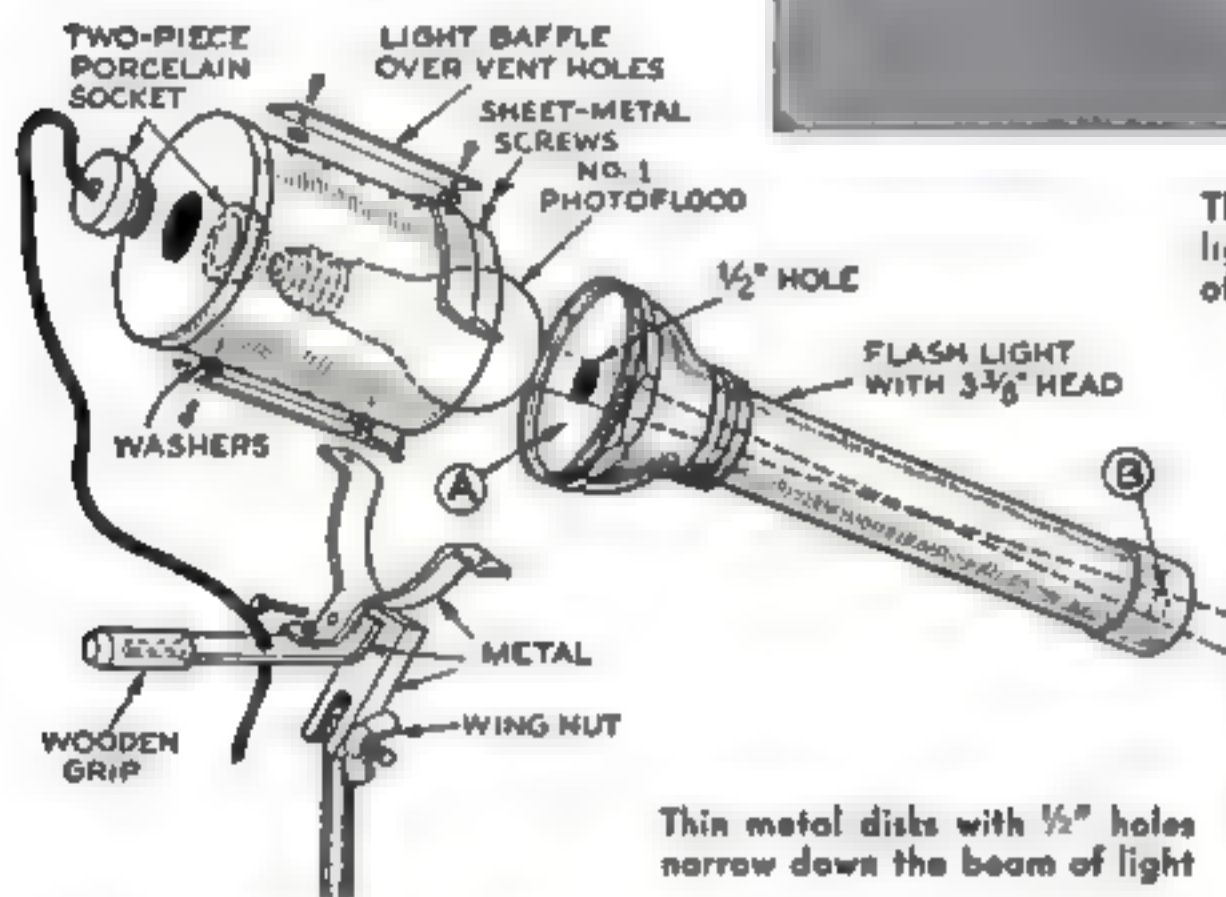
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Baby Spotlight

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The tiny beam is ideal for high-lighting and for spotting points of interest in table-top scenes



Thin metal disks with $\frac{1}{2}$ " holes narrow down the beam of light

CONDENSING lenses and an elaborate focusing device are not needed for this compact baby spotlight, which is easily made from a discarded flash light and a few odds and ends. It is mounted on a short length of iron rod of a diameter that fits any ordinary lightweight stand, and uses for its light source a No. 1 photoflood lamp. Instead of condensing lenses, a pair of thin metal disks with a $\frac{1}{2}$ " hole in each serve to narrow down the beam of light. Of course, the aperture size may be varied, but $\frac{1}{2}$ " holes will pass a beam ideal for average requirements, such as high-lighting the tip of the nose or chin in portraiture and spotting points of interest

in table-top photography.

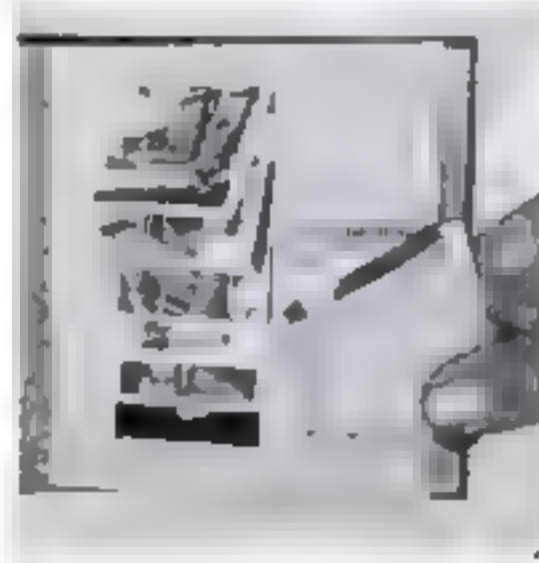
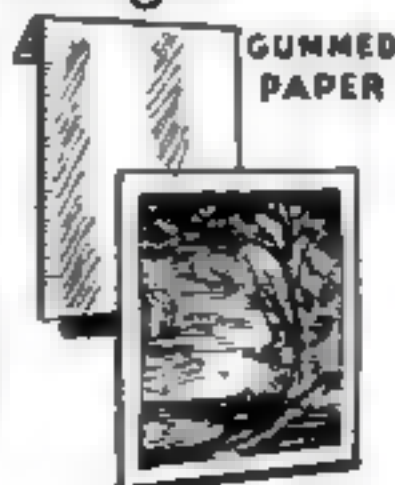
Disk A is inserted in the head of the flash light, from which the lens, lens rim, and reflector have been removed. The cap on the handle of the flash light is drilled to serve as the disk B. For a lamp house, use a common tin can that makes a snug fit over the $3\frac{3}{8}$ " head of the flash light. The parts are locked

together by a couple of small sheet-metal screws. The can is cut to a length that barely accommodates the lamp when it is screwed into the two-piece porcelain socket.

Ventilation is provided by perforating the lamp house at top and bottom and baffling the holes with metal strips raised on washers. A metal arm with a wooden grip is made as shown to control the swivel head, the tension of which is adjusted by turning the thumb nut. A coat of black crackle paint gives the baby spot a professional appearance. Its usefulness can be doubled by removing the flash-light handle, which allows disk A alone to pass a beam approximating that of a medium-size spotlight.—J. MODROCH.

Photo Prints Mounted on Hinges

FOR mounting pictures in an album to overlap each other, excellent hinges can be made from the heavy brown gummed paper used to fasten packages. The paper, which comes in rolls of different widths, is cut to fit the picture with an extra half-inch margin at the top. This is bent under to form the hinge. The overlapping style of mounting saves space and also keeps together several pictures of one subject.—MAX CHIDDIX.



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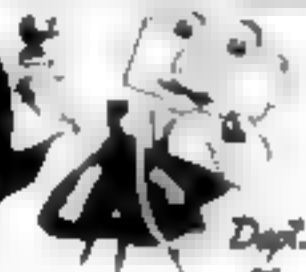
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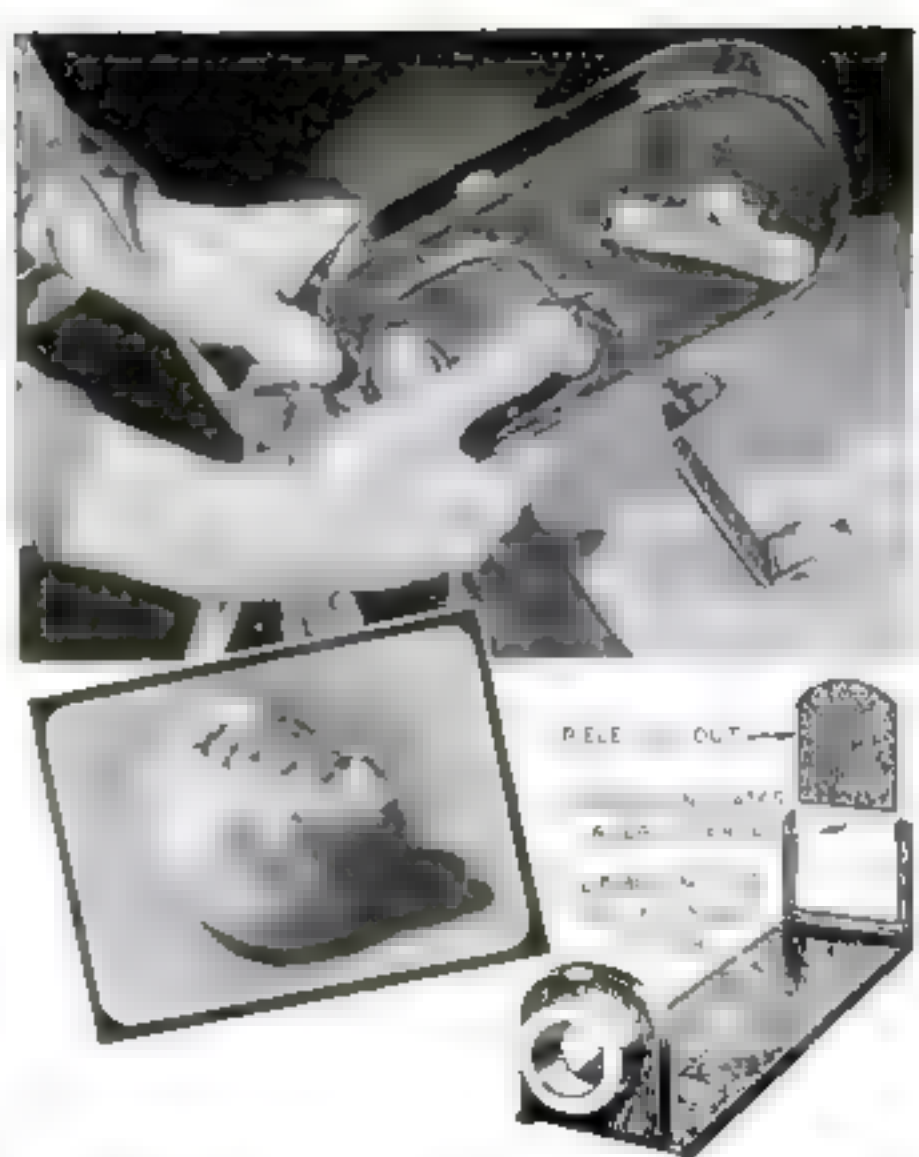
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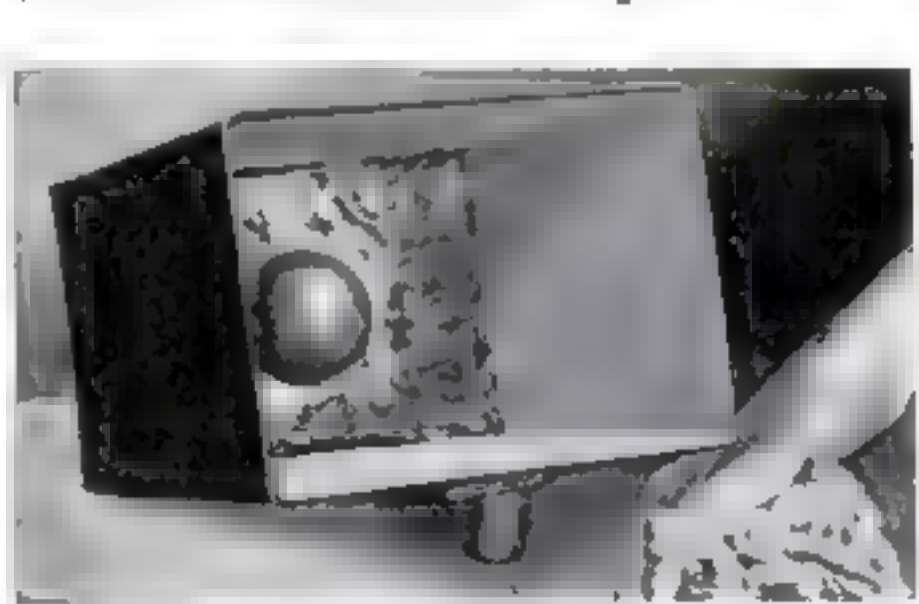
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Crumpled Foil Diffuses Light

IF A HOMEMADE enlarger of the diffusion type fails to give as even lighting as desired, try shaping a reflector from heavy crumpled aluminum foil. This is placed in the lamp house of the enlarger as shown in the photo above.—R. O. LISSAMAN.

Clogged Camera Shutter Soaked in Cleaner

SMALL particles of grease, oil, and dirt sometimes clog up the delicate working parts of a camera shutter. This condition can be corrected by removing the lenses and then soaking the shutter in carbon tetrachloride, which is a grease solvent and cleaner. The same treatment can be prescribed for a shutter that has accidentally been immersed in water, providing it is given immediately, before rust forms. Water, being lighter than the tetrachloride, will rise to the top and leave the camera shutter unharmed.—FRANK MCCARTY.



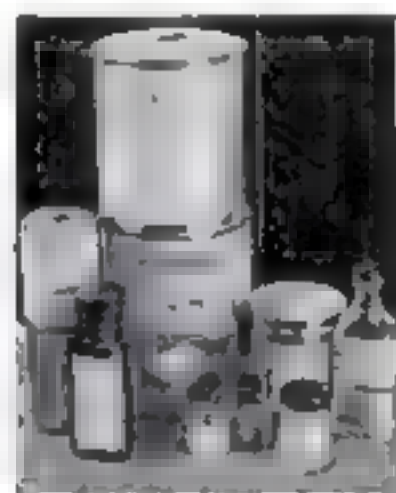
Carbon tetrachloride will dissolve grease and oil and clean out any dirt clogging the camera shutter

Basic Photo Chemicals Needed by Beginners

YOU will need certain basic chemicals in your darkroom if you wish to experiment with mixing your own solutions. For developers, these are sodium carbonate, elon or metol, hydroquinone, and potassium bromide. Buy $\frac{1}{2}$ or 1 lb. of sodium carbonate, but 1 oz. each of the others will be sufficient. For the fixing and hardening baths, get from 1 to 5 lb. of bulk hypo; either 8 or 16 fluid oz. of 28-percent acetic acid, and $\frac{1}{2}$ or 1 lb. of potassium alum. In addition, sodium sulphite is required for both types of solutions. Buy either $\frac{1}{2}$ or 1 lb. of it.

As you gain experience and extend your experiments, you are likely to find many chemicals to add to this list, but these are sufficient for the formulas a beginner usually mixes.

Be sure to obtain the chemicals from a reliable dealer in photographic or chemical supplies.—R. O. L.



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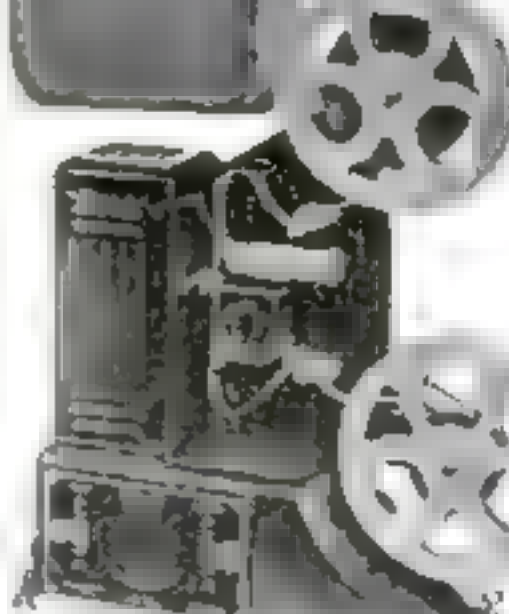
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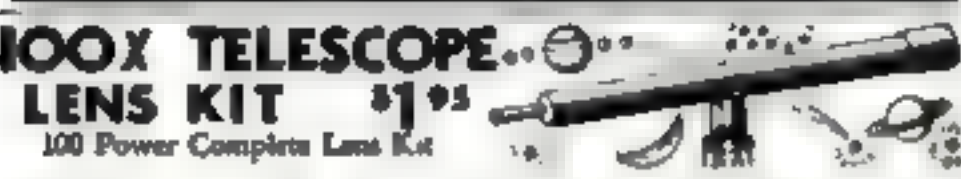
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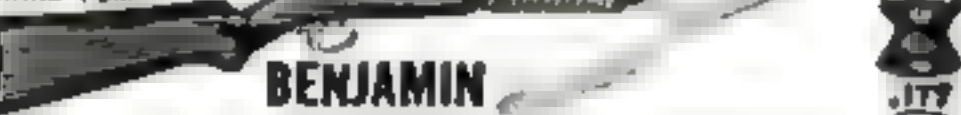


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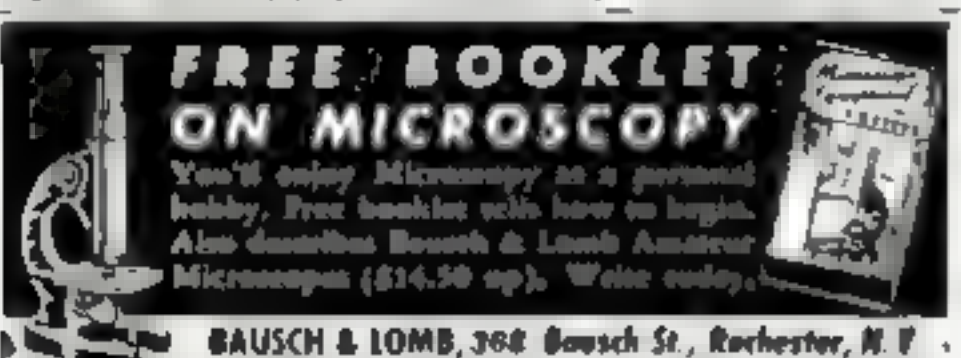
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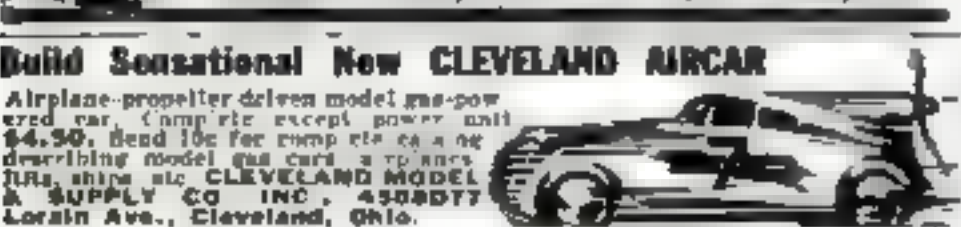
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Thrills of Flying Sailors

(Continued from page 48)

For dive-bombing practice, paper bags of aluminum powder, tossed into the ocean, spread glittering, fifteen-foot disks on the water. These shining targets are visible at 18,000 feet, an altitude from which the ample deck of the aircraft carrier appears no larger than a tiny piece of brown ribbon. As many as eight times in a single day, pilots will make screeching, three-mile plunges from the sky. The pull-out begins at about 2,500 feet, just after the dummy bombs have left the ship, and the plane levels out only 1,000 feet or so above the water.

The landings provide most of the fireworks on a floating airport. When planes are coming in, a special Diesel-powered whaleboat, holding emergency crews and a flight surgeon, is slung over the side ready to go into action if a flyer is forced down in the water. Two destroyers always follow 1,000 yards apart in the wake of the carrier, also ready for rescue work. And, on board, a special movie cameraman stands by, ready to film every landing that may end in a crack-up. Even the most trivial accident is recorded for study. Pilots, at regular intervals, see "crash shows." These reels, showing accidents on board the various carriers, help them avoid making mistakes that have brought others to grief.

Sometimes as many as seventy-four high-speed ships will be wheeling about an aircraft carrier, getting into the "landing groove," ready for coming aboard in quick succession. When they do come in, they land only a few seconds apart. This exhibition of precision flying is a stirring spectacle. For the pilot, it provides a thrill that never grows stale.

I have been through it more than 300 times. Once, off Hawaii, ground swells were lifting and dropping the bow of the *Lexington* through a fifty-foot arc when I swooped down for a sixty-seven-mile-an-hour landing. Another time, the *Saratoga* was turning as well as steaming full speed ahead when the engine of my torpedo plane sputtered and I had to sit down on the deck as best I could. In normal landings, as well as in take-offs, the aircraft carrier is running at peak speed into the wind.

Just as the quarterback directs a football team, so the signalman on the bridge of an aircraft carrier directs the pilots in landing. He is always a veteran flyer himself and he studies the peculiarities of each of the pilots on the carrier until he knows what he will do in any kind of an emergency. With a yellow flag in either hand, he "lands" the ships in

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quick succession. From 300 yards out, you watch the signalman, not the deck, when you sit down on a carrier. If you are coming in too fast or are likely to overshoot, he gives you the "wave-off," chopping the two flags across each other in front of him. If you are all right, he swiftly draws one flag across his throat, the signal to cut the engine. The signalman is the key to successful operations on a carrier; it is he who must make split-second decisions that enable scores of planes to land with clockwork regularity.

Hardly has your plane stopped rolling down the deck, when you land, before experts are swarming over it for inspection. Riggers go over the wiring, mechanics examine the engine, gasoline crews fill the tanks. Every plane on an aircraft carrier is filled with fuel, ready to go, at all times. As soon as all the planes have landed, they are rolled back to the stern, each to its "stall," or spot where it is secured by ropes attached to eyelets in the deck. Rain or shine, almost all of the aircraft are left in the open. During high winds, the mechanics place special boards called "spoilers" along the leading edges of the wings to break up the air currents and reduce the strain.

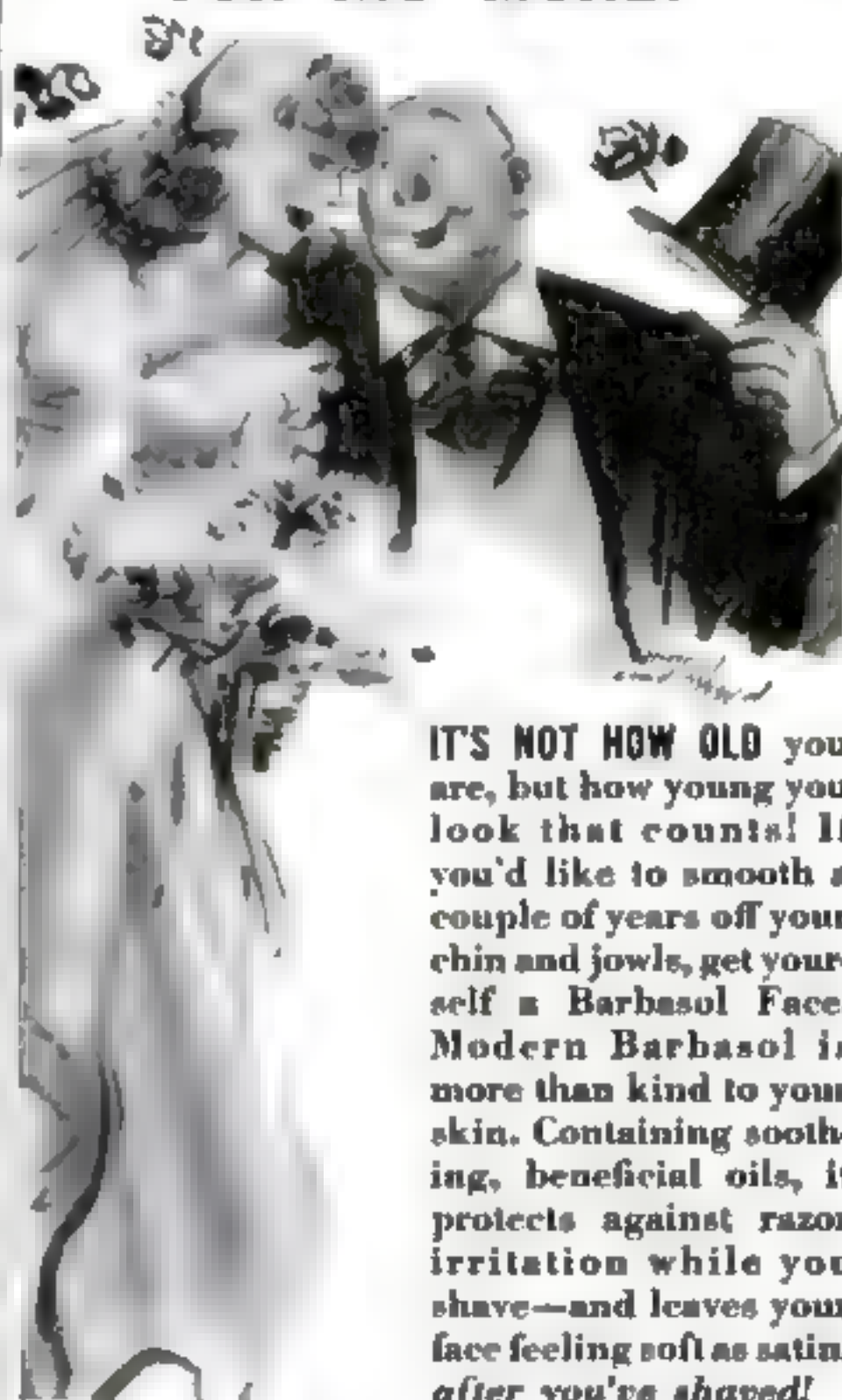
It is during the quarterly Navy games that activity aboard an aircraft carrier reaches its peak. Scouts, patrol planes, attack squadrons are taking off and landing at frequent intervals. Sometimes, for seven or even ten days at a stretch, the pilots will follow a grueling schedule that starts with reveille at 3:30 in the morning and ends with taps at 9:30 in the evening. The work is strenuous but it has the attraction of a thrilling, exciting game. Of the 1,400-odd men who live aboard one of these floating airports, only about 100 are carrier pilots. Highly trained specialists, they fill a job that is tops when it comes to variety, speed, and thrills.

POPULAR SCIENCE Question Bee

DID you try your hand at the Question Bee on page 128? If so, you can check your results by comparing your answers with the list below, in which letters indicate the correct replies. Give yourself five points for each one you had right. A score of 75 to 85 is good; 90 or better is excellent.

- | | | | | |
|------|------|-------|-------|-------|
| 1. b | 5. b | 9. e | 13. a | 17. b |
| 2. c | 6. b | 10. b | 14. b | 18. c |
| 3. c | 7. d | 11. c | 15. a | 19. a |
| 4. b | 8. b | 12. b | 16. c | 20. d |

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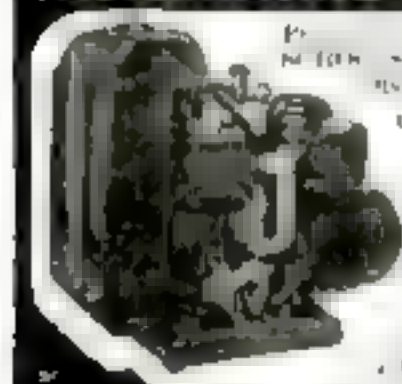
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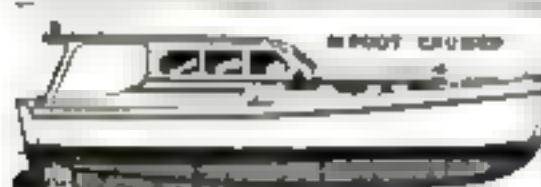
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Streamlining Our Army

(Continued from page 85)

which make it possible for an instructor to teach recruits all they need to know about close-order drill in a few hours. The new regulations remained tentative and experimental for the better part of ten years. They became official a few days after General George Marshall was appointed Chief of Staff last year.

Staff officers continued to sweat over new tables of organization for the infantry division—the basic organization of the Army, but they were unable to evolve anything which seemed more efficient than the old World War "square" division. By pruning the muster rolls of the regiments they reduced the division's peace strength to 13,500 and its war strength to 21,500. Efforts to make it still smaller in the interest of increased mobility were blocked by the then unanswerable contention of experienced officers that further reduction would result in a fatal loss of fire power—that the fighting value of an infantry division shouldn't be measured by how fast it can move, but by how many men it can put on its firing line.

It was, oddly, a civilian that provided the answer to the soldiers' argument and who made the Army's new "streamline" division practicable. His name is John C. Garand, and he is an employee of the Government armory in Springfield, Mass. The answer he provided is a gas-operated semiautomatic rifle which is believed to be the best military shoulder weapon in the world.

Assuming that 100 men armed with the Garand can produce a volume of fire equal to that of 250 men armed with any rifle used by the infantry of any other army, the General Staff ordered the organization of five "streamline" divisions which can hit hard as well as move fast.

There are no brigades in the new division, which is known officially as the "triangular division." It is composed of three regiments of infantry, two regiments of field artillery, a division headquarters and military-police company, an engineer battalion, a quartermaster battalion, a medical battalion, and a signal company. With the additional medical personnel attached to its various organizations, its authorized peace strength is 8,953 officers and men, but as 390 are inactive in peace, its actual peace strength is 427 officers, three warrant officers, and 8,133 enlisted men—a total of 8,563. Its war strength is about 12,000. Its 1,357 motor vehicles—trucks, tractors, field cars, trailers, motor cycles, and motor-cycle side cars—can transport or tow all its artillery,

heavy weapons, and equipment, and also carry a considerable number of its men. Certainly its fleet of motor vehicles will increase its marching rate considerably above the twelve and a half miles a day which was normal for the foot-slogging, mule-drawn World War division.

The streamline division's three infantry regiments are the backbone of its fighting power. Each of them has an actual peace strength of 1,964 officers and men, and a war strength of about 2,400. At war strength each regiment would have 1,500 Garand rifles in its firing line.

The organization of the infantry regiment is triangular. It has three battalions. Each battalion has three rifle companies and a heavy-weapons company armed with sixteen .30 caliber machine guns, two .50 caliber machine guns, and two 81-millimeter mortars—smoothbore, curved-fire weapons which can lob a 7½-pound fin-type projectile two miles. Each rifle company has a headquarters platoon armed with three 60-millimeter mortars—light mortars which fire a 3.3-pound projectile to a maximum range of about a mile with remarkable accuracy—and three rifle platoons. Each rifle platoon is composed of three rifle squads of eight men each at peace strength and of twelve men each at war strength. All the members of the rifle squads are armed with the Garand—or will be as soon as enough Garands are available. The 15½-pound automatic rifles which were distributed one to a squad under the old infantry organization are out. So are rifle grenades.

For protection against tank attacks, the regimental headquarters company is equipped with six of the new 37-millimeter cannon which are capable of thirty shots a minute and whose two-pound shells will "kill" any light or medium tank at 1,500 yards. Weighing only 900 pounds, and mounted on pneumatic-tired carriages, they are easily handled by an eight-man squad.

One of the new division's completely motorized artillery regiments has thirty-six 75-millimeter guns which, modernized, have a range of almost eight miles. The other regiment has sixteen 155-millimeter howitzers.

Our new infantry division is the smallest of any in the world's armies. The war strength of the French division is about 14,000, of the German division about 15,000, of the Italian division about 17,000, and of the British division about 19,000. But our streamline division's 4,500 Garand rifles give it greater fire power than that of any of the European infantry divisions. And it is fire power, not the number of men used to produce fire power, which is the real measure of an infantry division's strength.

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The Newest Warplane Tries Its Wings

(Continued from page 43)

hour, 150, 155, 160. Around the mile level, he found the plane rises best at 155. Seven thousand feet higher, her most efficient climbing speed is 150. Back and forth, between 160 and 135, her velocity ranges as she moves upward. A pilot flying to meet an enemy need only consult Johnnie's chart to know exactly how best to get up there first.

For twenty years military pilots have dreaded stalling in dog fights and spinning to their deaths. Tip stalls, in which the plane loses flying speed and falls off on one wing, have presented an ever-increasing problem as tapered wings have come into vogue. What military flyers want is not a plane that cannot stall, but one which stalls properly. Many times Johnnie stalled the Vanguard by decreasing speed in level flight or pulling her into a stall following an increase in speed. "She's a little too abrupt," he reported one afternoon. "I'd like to smooth her out."

Working secretly under direction of Vultee's chief engineer, R. W. Palmer, Consulting Test Pilot Vance Breese developed a tiny half-round, pencillike gadget, made of duralumin. Several mornings later, Johnnie found two of these devices, each eight inches long, fastened to the leading edge of the wing. "These," explained Rockefeller, "will set up twin turbulences in the air stream which will progress evenly to the tips." Which Johnnie interpreted to mean that the stall would start near the center section instead of at the tips.

Again he climbed, and again he pulled the pursuit ship into a series of stalls. Several times that day I saw the plane pull up, and fall straight down on its nose, with no change in direction or tendency to spin.

Long before Johnnie completed his breath-taking tests, new developments were under way at the Vultee plant. Johnnie had been flying behind a 1,200-horsepower engine, whose power flowed into an electrically controlled prop. This ship already is being demonstrated to representatives of warring powers. But Uncle Sam has an ace up his sleeve. One day soon an eighteen-cylinder engine which develops 1,600 horsepower will be stuck in the Vanguard's nose. Then Johnnie will start, all over again, the tedious task of making new records, to find out just how much faster the warplane will climb and fly. These figures will be America's secret, to be closely guarded until something faster comes along.

For Good Photos Use Filters

(Continued from page 121)

Make sure it is haze and not smoke or dust you are trying to filter. These may sometimes look much alike in the distance, but there's a very important difference. Smoke and dust are not transparent. You cannot filter them out.

Aero No. 1, then, is my most important filter. I use it for virtually all shots where I want detail in the distance. It catches light clouds, rendering them lightly as it causes the sky to go a little darker by cutting out some of the blue with the violet.

The K2 filter cuts off a little more from the spectrum than the Aero No. 1, taking out considerable blue, darkening the sky more, blocking off high lights, and allowing softer reds, browns, orange, green, and indigo to reach the emulsion in time for registry. Without a filter, water appears on the print to be white. With a K2, you see lakes, streams, and the sea more nearly as nature paints them for the eye.

When you become experienced in the use of the K2, you will find it produces some very pleasing effects. It does not make the sky black, nor does it remove the luster and life from green trees. And it turns water only a trifle darker. As for human faces, you'll be surprised to discover dramatic effects to be obtained. Flash-light bulbs, high in blue light, enable you through K2 to discover photographically a rich texture in the skin seldom caught without the filter.

You will find the 23A (orange-red) somewhat more difficult to use. Yet it will yield marvelous pictures. This one is properly employed on clouds in a hazy sky, on a mountain stream, or on a rocky mountain which offers a monotone of color yet which is rich in browns, red, and green. This filter builds contrast by accenting high lights. Orange-red produces a light effect, while light blue goes darker, thus giving pictures a contrast the eye does not visualize. It should never be used on the desert or water where only a flat expanse rolls out before the camera and a great deal of blue light sweeps down from an unbroken sky. Like K2, the 23A usually turns out a better job early and late during the day, rather than in brilliant midday light. Some of my most dramatic pictures have been taken at sunset with it.

I cannot overemphasize the dramatic effects obtainable with filters. Perhaps I should say the Wratten G will produce a superdramatic rendering of already dramatic subjects. This is a "narrow-cutting" filter which takes out all the blue and prac-

(Continued on page 222)

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For Good Photos Use Filters

(Continued from page 221)

tically all the violet, and passes green, yellow, red, and overlaps (browns). Some experts use the Wratten G on the majority of their pictures, simply because it heightens effects. In general, use the G when you want to make water dark and forbidding (storm scenes), to make clouds against clear sky look like thunderheads. Whereas 23A will give details of a gathering storm, Wratten G produces the ominous contrast which threatens thunder, lightning, and downpour. I prefer Wratten G to picture a clear sunset, and use 23A to capture a cloudy sunset.

Remember that if you want snappy, well-exposed negatives that make the brilliant prints the other fellow always seems to get, you must remove as many variables from your operations as possible. These variables are, broadly, film emulsion, exposure, and processing.

You may, for example, choose orthochromatic, panchromatic, or ultra-panchromatic film. Whatever you do, pick one, and stay with it through hell and high water until you know what it can do—then continue to stay with it. My personal preference is the slower or medium-type panchromatic.

The best way to remove the exposure variable is to own and use constantly a good photo-electric exposure meter. Study of the instructions accompanying a good type of meter will enable you to make your exposures properly, bringing you a photographic thrill you have never known.

Processing proves to be the Waterloo of many shutter clickers. Right here, I think I can give you the best advice you have heard. If you are not going to make big enlargements from your negatives, and do not make them larger than 5" by 7" from 35-mm. film, and 8" by 10" from 2 1/4" by 3 1/4" film, don't worry over superfine-grain developers.

Use the Eastman D-76 or the new DK-20. Both are easy to mix, and keep well. Further, they will give you all the brilliance and clarity you want. When, at last, a developer satisfies you, stay with it, turning a deaf ear to the friend who has just discovered a new wonder developer. Get a good thermometer and use it. Keep your solutions between sixty-five and seventy degrees F. Use only fresh hypo. Keep your developer in an air-tight bottle, away from the light, and in a cool place. Learn to develop according to time and temperature. By following instructions and using the appropriate filters, your pictures soon will bring you an unexpected pleasure.

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This One



N79N-S7R-FK1T

Learn To Dive

(Continued from page 63)

fan and nothing will stop you. Incidentally, if you have a friend interested in diving, practice together, so that each can observe the other's dives and offer constructive criticisms.

Now for that first compulsory dive, the forward header. Take off with a run as you did in your feet-first practice jumps. As you leave the board, lean slightly forward—but remember, too much forward leaning will cut down the height of your dive and tend to make your feet flop over as you enter the water. Lift your arms and spread them outward as the board flips your feet up. Strive for height, and in the air keep your legs tensely stretched, knees stiff, toes pointed, head back, and eyes open. Of course, that's a lot to remember, and the first time you try it you'll feel like collapsing in mid-air. But if you do, the dive will be ruined, and the smack you'll get on hitting the water will be a first-class reprimand for losing your nerve.

If you've caught your breath, let's get on to the back dive. First, balance yourself on the balls of your feet on the end of the board, back to the water, with your arms out in front of you at shoulder level. Now raise your arms to a vertical position, throw your head back, and fall into a back bend like those you've seen dancers and acrobats do. As long as you keep that head of yours back as far as you can—and only that long—your body will arch around and land you easily in the water head first. Once you've mastered the trick, try springing up from the board to gain height, instead of just falling back from it. Keep your nerve, think the dive through first, and soon you'll be executing not only the back header but also more spectacular dives in expert fashion.

In a championship meet, there are five judges scattered at vantage points around the pool. Each judge scores every dive on a basis of ten points for perfect and zero for total failure. Every type of dive has an individual rating, depending on its difficulty. A combination of these figures gives you your score.

Even if you never get into a meet, your ability to dive will pay you dividends for many years and in more ways than one. For learning to dive is really a complete course in physical education, developing nerve, balance, poise, and muscular coordination. But above all, diving is a whale of a lot of fun.

Good luck. See you on the same springboard one of these days.

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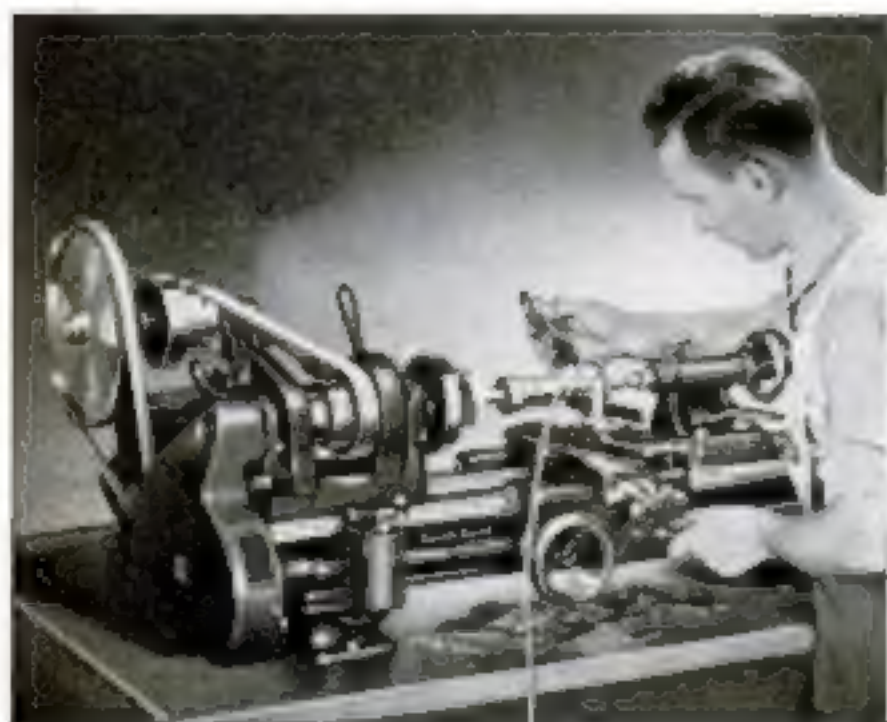
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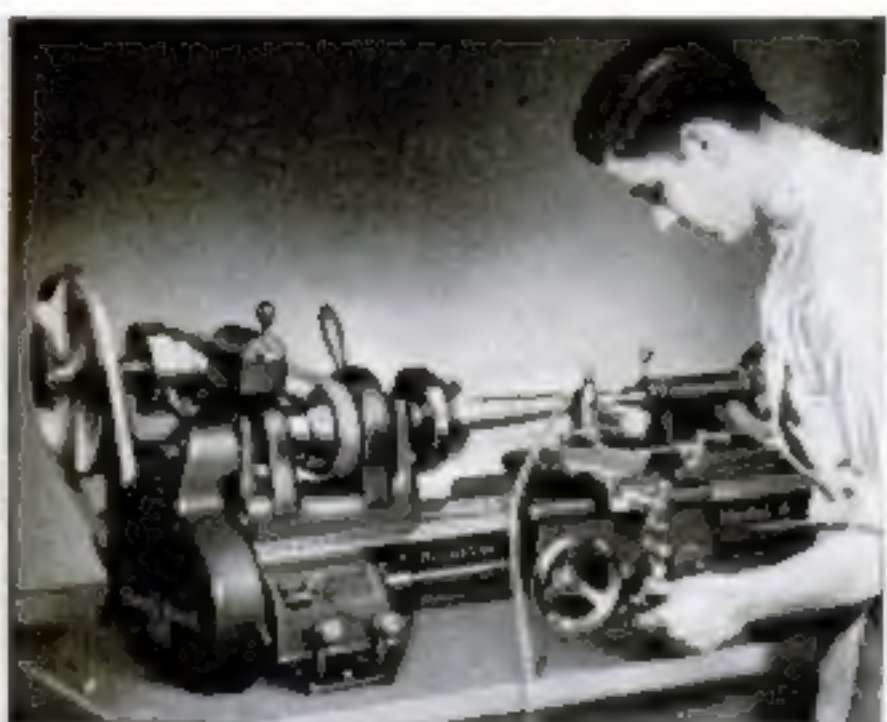
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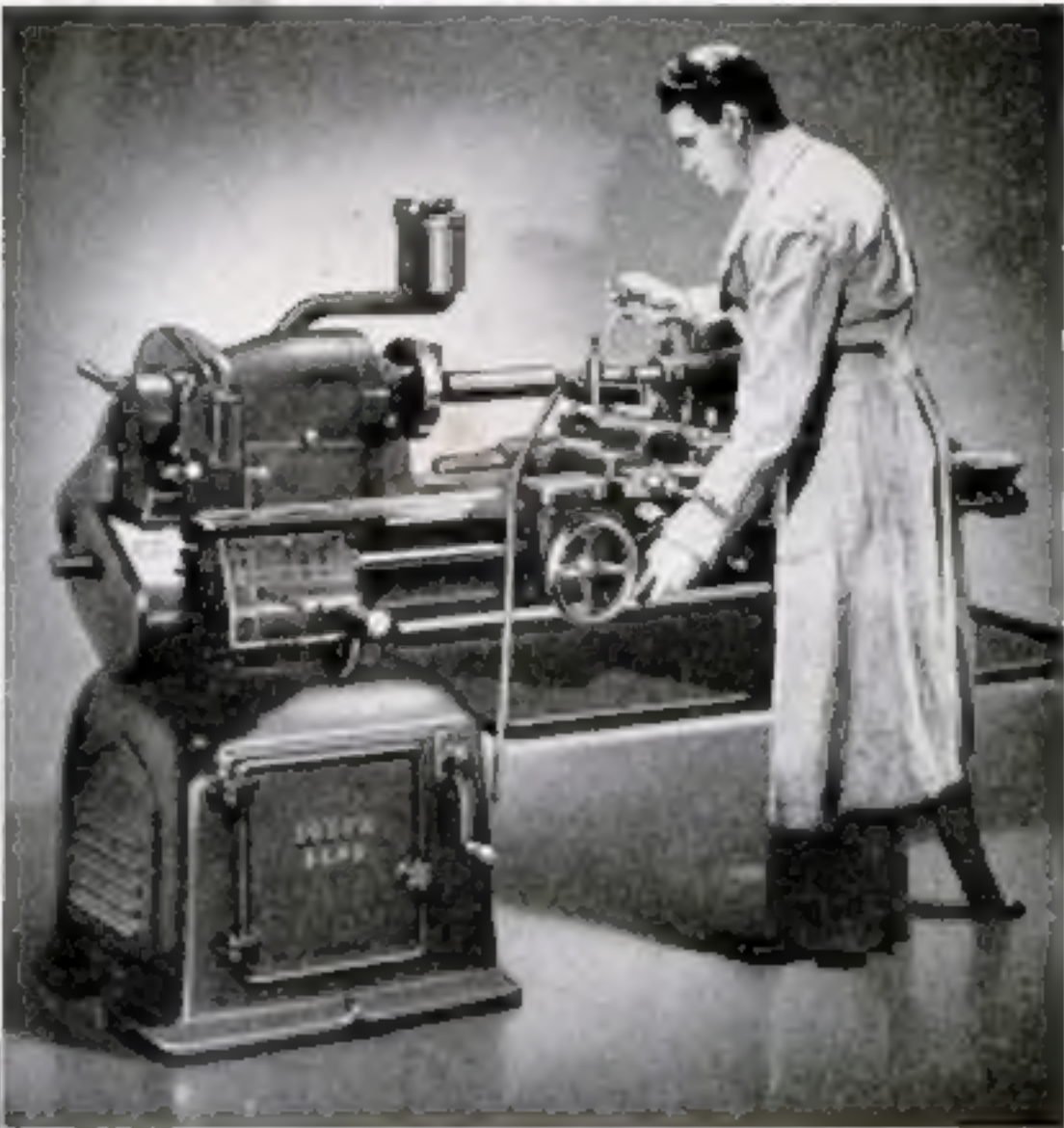
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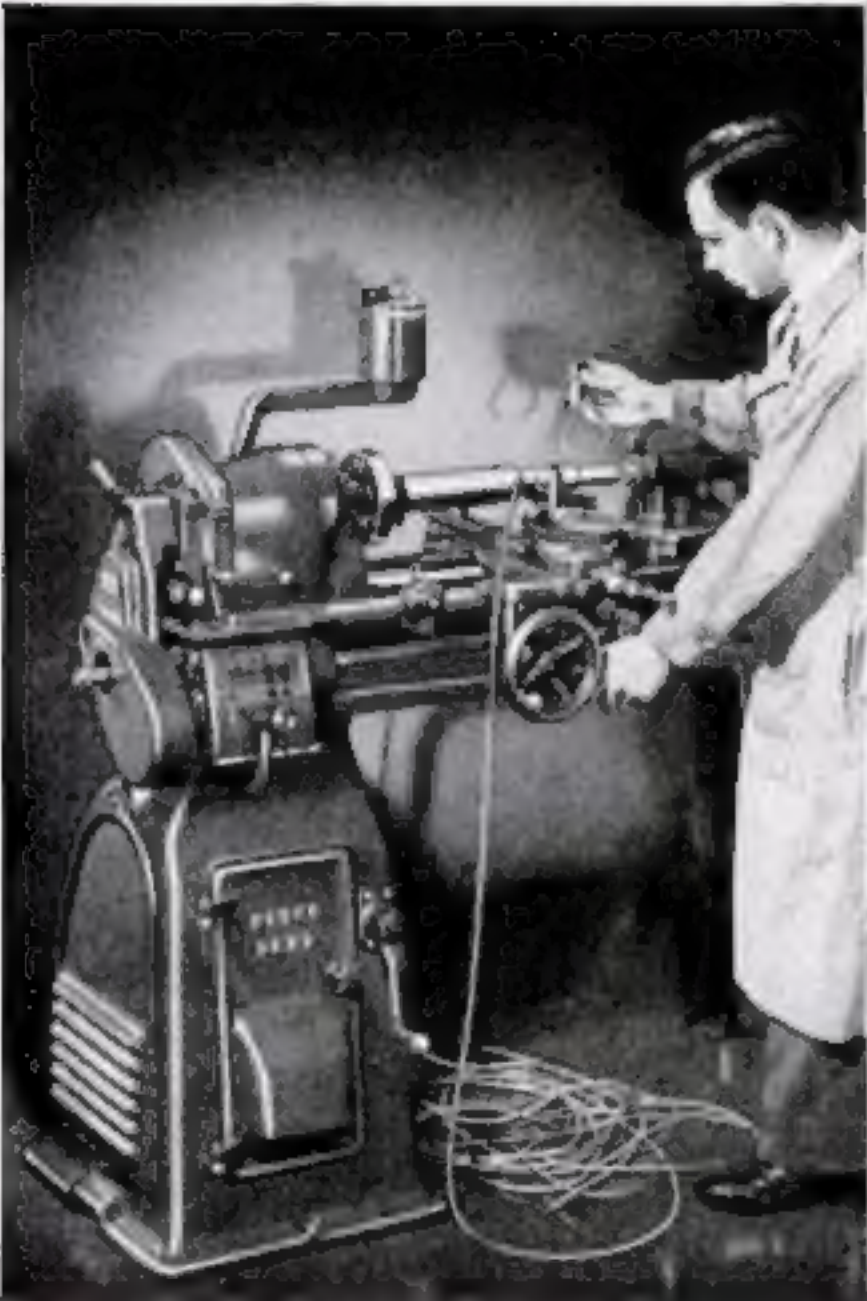
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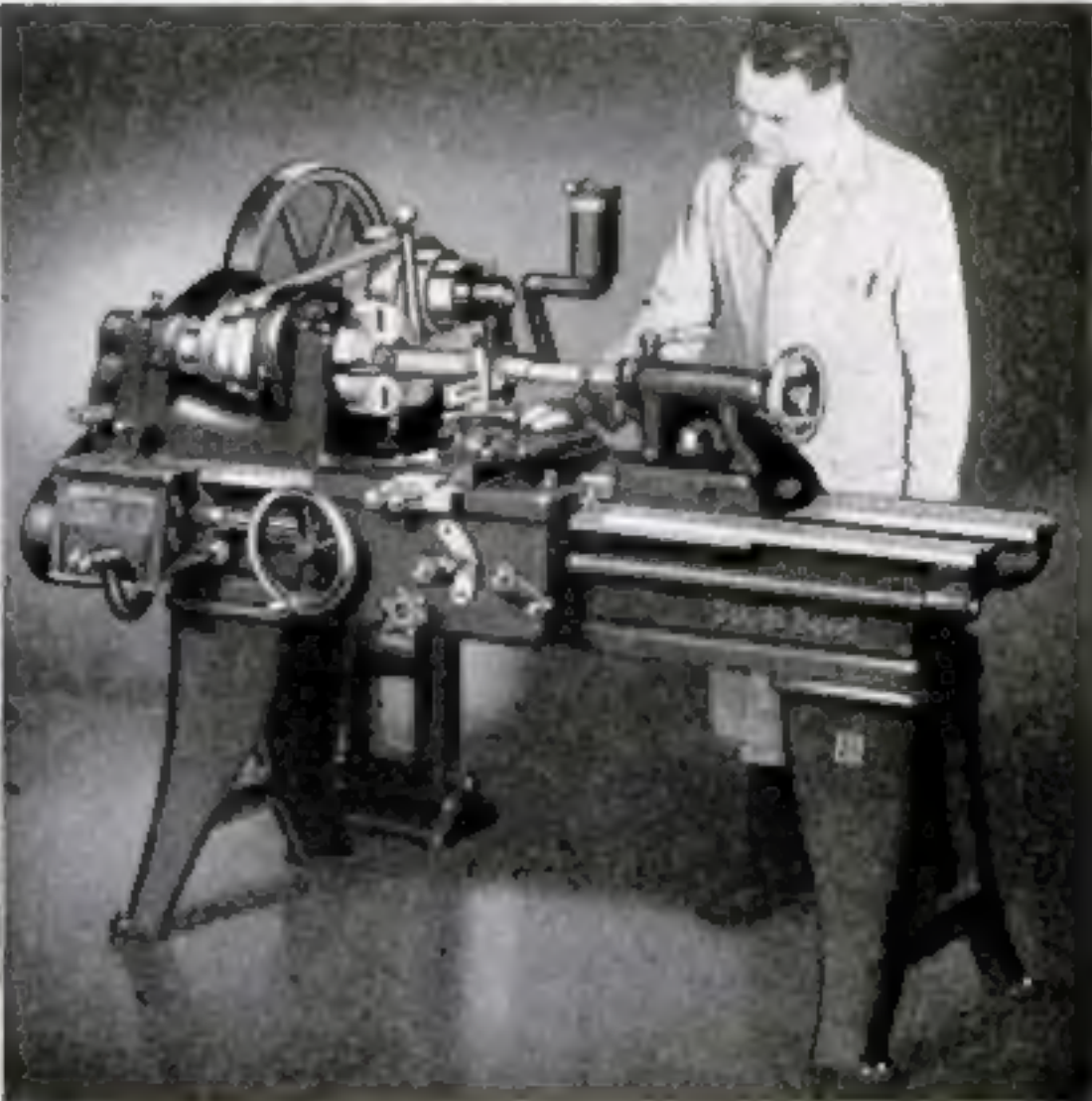


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